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(SEE PAGE 120)

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64/128 VIEW

A veteran 128 publication turns its editorial eye on the 64 with the launching of *Twin Cities 128/64*.

Tom Netsel

Gazette celebrated its tenth anniversary when the July issue rolled off the presses. That's almost 120 issues. (We missed a couple during the summer of 1990.) *RUN* made it to issue 99 before it closed its final page.

Computer magazines come and go, and those that hitch their editorial wagons to one machine often experience a meteoric ride. Some flash onto the scene, burn brightly, and then fizzle away; while others maintain a steady glow.

Gazette started its association with the 8-bit Commodores by focusing on the VIC-20 and the 64, adding coverage of the Plus/4, 16, and 128 when those machines came along. When the 64 and 128 emerged as the leaders, we followed the numbers and concentrated our coverage on those machines. Surveys tell us that 70 percent of you own 64s.

Few publications have devoted coverage exclusively to the 128. *Twin Cities 128* was the exception. Founded by Loren Lovhaug in 1985, *TC 128* was primarily a technical publication that appealed to 128 programmers. It had its fans, but they were not enough to keep it in operation. It folded in 1991.

And then along came John W. Brown, president of Parsec. He bought the rights to the magazine a few months later and resumed publication. Coverage at that time was still limited to the 128.

When *RUN* died last year, Brown figured that his publication should offer some support to 64 owners

in addition to the 128 crowd. So with issue number 33, Brown launched the new *Twin Cities 128/64*. Produced on a 128-D with a laser printer, *TC 128/64* devotes about half of its 56 pages to each machine. Look for reviews, articles, GEOS info, and technical pieces, but don't expect a large number of type-in programs.

The cost for U.S. subscribers is \$24 for six issues. The magazine and companion disk cost \$40. To subscribe or for more information, write to Parsec, P.O. Box 111, Salem, Massachusetts 01970-0111. You can also write for a free copy of the magazine.

In addition to *Twin Cities 128/64*, Parsec offers a variety of disks, fonts, GEOS graphics, and other products for 64 and 128 users. SIDplayer fans should note that COMPUTE has sold the exclusive distribution rights to the book and disk to Parsec. That book/disk combination should be repackaged and for sale by now.

In "Upgrading Without Changing Platforms" (June 1993), it was reported that Parsec had dropped plans to produce a board that would let a 128 operate at 6-12 MHz. Well, that wasn't entirely accurate. Brown told me that the company working on the prototype had dropped it, but he still intends to produce it—and one for the 64 as well.

Brown says the product is now an external cartridge, CMD compatible, that will plug into the expansion port. It will probably use a 65C816 chip and operate at 12 MHz. The cost is expected to be about \$200. □

GAZETTE

64/128 VIEW

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A veteran 128 publication now covers the 64, too.
By Tom Netsel.

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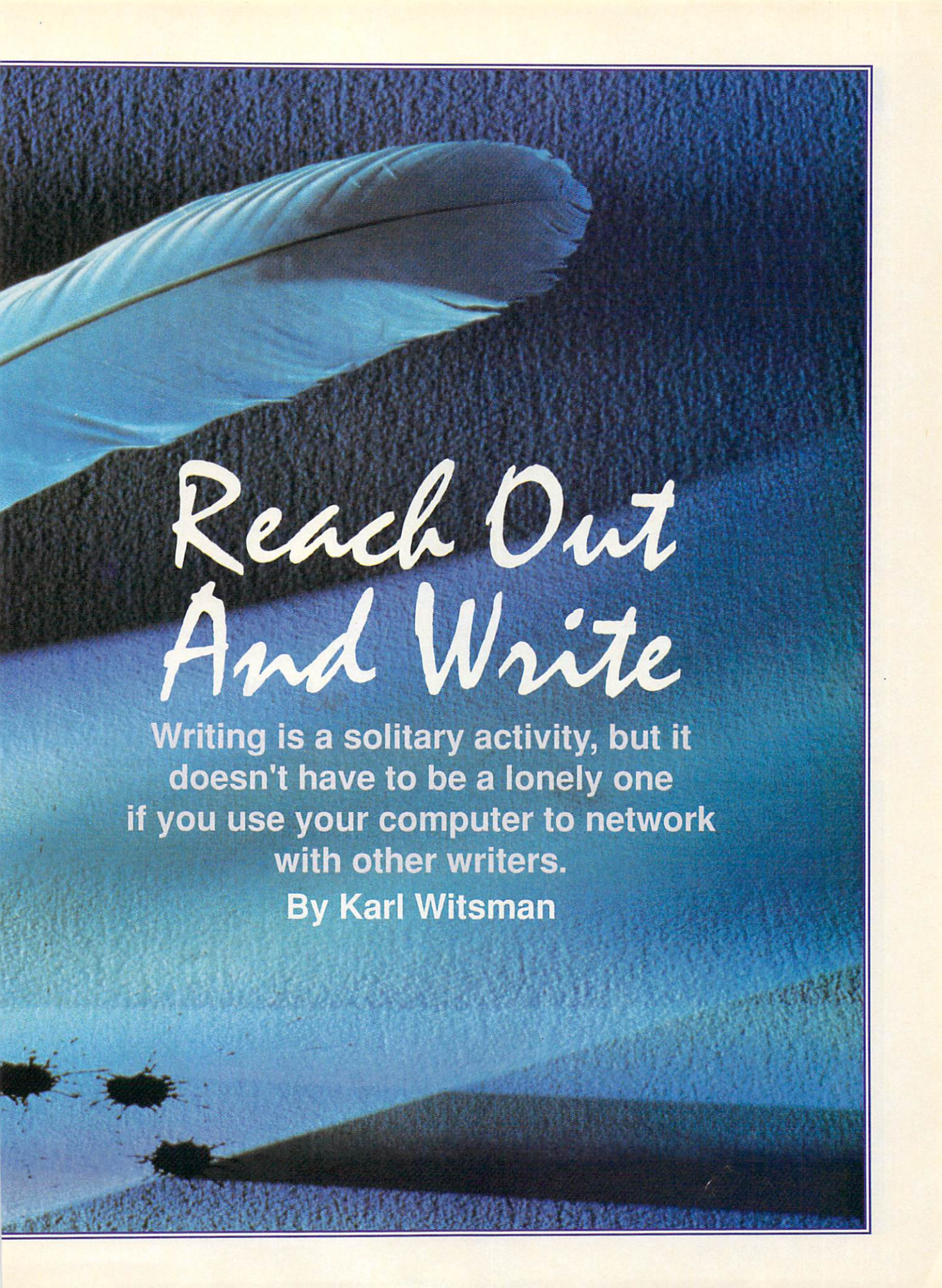
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Reach Out And Write

Writing is a solitary activity, but it
doesn't have to be a lonely one
if you use your computer to network
with other writers.

By Karl Witsman

If you're a writer, you know what kind of power a computer gives you—power that you never had with a typewriter. But if you use your 64 only for word processing or the occasional game of Space Invaders, you haven't explored its most powerful use. There's a great force out there just waiting for you to tap into it with your computer and modem. It's called networking, and it can multiply your computing power and help your writing!

Most folks using computers have heard of BBSs or bulletin board systems. The popular notion of a BBS run by a teenaged hacker may have some validity, but many systems are run by serious computer enthusiasts, computer clubs, schools, and businesses. Some are created for fun; others have a more serious intent. All require a modem to connect your computer to a telephone line.

Running any BBS can be troublesome and is definitely time-consuming for the owner or system operator (sysop). These are labors of love, since most BBSs bring in no money. Sysops usually appreciate any help they can get, even if it's only through the messages posted by callers, but volunteers can help in other ways as well. Many boards have areas devoted to special topics, and often these areas are directed by outside sysops. I have volunteered on more than one of my local boards to form a writers' area. This is a place where local writers can converse about literary topics, and this is the place where networking comes into play.

A Writer's BBS

To share the fun and information, try to find a BBS in your local area. If you can't locate one with a writer's SIG, here are some you might want to try. Several of these BBSs have specific writing areas. All allow access up to at least 2400 bps and run 24 hours.

- Almost Paradise, Oakwood, Illinois; (217) 354-4711. The sysop is Christy Blew. Leave a message for Karl Witsman, user number 56. If I can find more BBS/writing information, I'll reply with it here.

- Electronic Pen BBS, Harrington Park, New Jersey; (201) 767-6337.

- Data Central, Indianapolis, Indiana; (317) 543-2007.

- Heartland Free-Net, Peoria, Illinois; (309) 674-1100.

- Unique and Nifty BBS, Crawfordsville, Indiana; (317) 364-9600.

- Voyager BBS, East Lansing, Michigan; (517) 641-4367.

For additional BBS sources, try these publications or bulletin boards.

- *BBS Callers Digest*, 701 Stokes Road, Medford, New Jersey 08055. Its BBS is The Livewire at (609) 235-5297.

- *Boardwatch Magazine*, 5970 South Vivian Street, Littleton, Colorado 80127. Its BBS number is (303) 973-4222.

- *Infomat Online Weekly PC News Magazine*. For information about BBSs everywhere, call (913) 478-9239.

Write Here

On a BBS, writers can discuss anything, such as the mechanics of manuscript preparation, agents, who uses/hates outlines, how to query about possible articles, or how to deal with deadlines. Some topics are even more involved, such as "Where does this sex scene fit into the story?" or "How do I show my character's thinking processes?" For questions that have no simple answers, the opinions of other writers can often prove helpful. If you're not a member of a writing group that meets in person, this electronic connection may be the only way to pick the brains of others in your field.

Three Approaches

There are three main ways to converse on a BBS. The first is simply to leave a message in a general message area and let other callers read and respond to it. In most cases, other callers can respond on the same message area or send you a private reply through electronic mail.

The second method of exchanging information with other computing writers is through SIGs (Special Interest Groups). As their name implies, these areas concentrate their focus on a specific topic of interest and one could be devoted to writers.

Echo, Echo

The third, and most sophisticated, method of communicating on local BBSs is Echo messaging. Echoes are a number of BBSs that form a net-

Writers' Forums

The commercial online services offer a variety of opportunities for writers to meet and exchange ideas. Here's a sampling of what's available.

GEnie
401 N. Washington St.
Rockville, MD 20850
(800) 638-9636

Jack Smith, screen name *Writers.Ink*, runs the Writer's Roundtable. The nonfiction group meets Wednesdays at 9:30 p.m. General Writing meets Sundays at 9:30 p.m., and the Poetry Meeting is held on Tuesdays at 10:00 p.m. Romance Writing meets Thursdays at 9:00 p.m. All times are Eastern Time.

QuantumLink
8619 Westwood Center Dr.
Vienna, VA 22182-9897
(800) 782-2278

The Writers' Forum meets every Tuesday at 10:00 p.m. ET. Contact Karl Witsman, whose screen name is *KarlW3*.

The Writers' Forum consists of a very imaginative bunch. After the main topic has been thoroughly discussed, the group talks about current writing projects and other topics.

DELPHI
3 Blackstone St.
Cambridge, MA 02139
(800) 544-4005

The DELPHI Writer's Group is for all writers of fiction or nonfiction. "We do admit to being a bit mercenary about writing at times, but of course that's all a part and parcel of getting into print—our primary interest here!" says the introductory text. Features include a Critique Network and a special database for writers' résumés, plus public domain and shareware software for writers.

Members are also eligible for special discounts on books, products, and supplies for writers. There are special databases for poets, screenwriters, and fiction and nonfiction magazine and book authors.

Poetry Conference meets Tuesdays at 9:00 p.m. ET, and the Creative Writing Workshop is held Monday nights at the same time. Contact persons are Ralph Roberts, whose screen name is *Author*, and Michael A. Banks, whose screen name is *Kzin*.

CompuServe
5000 Arlington Centre Blvd.
Columbus, OH 43220
(800) 848-8199

CompuServe has a Desktop Publishing Forum, a Desktop Vendor Forum, and Journalism Forums. Contact Don (76711,437) or Thom (76702,765) for more information about items of interest to writers.

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work. Most of these networks are set up by sysops who know sysops in other towns. Using this system, a writer in Connecticut might leave a message on his or her local BBS. Around 3:00 a.m., the Connecticut BBS might call a BBS in New York and exchange messages, being careful to keep the writing messages separate from those dealing with computers, sports, and other topics. The New York BBS might then call a BBS in Ohio and repeat the process. In this way, the messages echo around the country.

When I call my local board, I can read the message posted by the Connecticut writer and respond to it. Writers all around the country have an opportunity to respond, and these responses are entered into the network. In a day or so, after the BBSs exchange messages again, the Connecticut writer can read the responses, as can all of the other writers on the network.

One such echo is the National Writers Echo. I was a local monitor here in Danville, Illinois, on the Friendship BBS, which was run, before his death, by Terry Claybaugh. Through this network, I exchanged messages with many writers of varying degrees of fame, including Billie Sue Mosiman (author of *Wire*) and John DeChancie

(author of the Starrigger series and the Castle Perilous series).

Such free exchanges of information and opinions with other working writers can expand your knowledge and help you keep track of up-to-the-minute publishing trends. All messages and mail are automatically date-stamped, so you can ignore old information and be aware of the most recent updates and changes.

REF# 432

POSTED: 04-20-91

FROM: Karl R. Witsman

TO: All

Writers, I'm steaming mad! The U.S. Copyright Office has raised the copyright fee from \$10 to \$20 to register our works! This may be fine for those who write nothing but books, but for those of us wishing to register short stories or articles, it's an outrage. Next time we must not let this happen; next time we must unite and apply our skills in written communication in letters to the Copyright Office, Congress, and the president. At five cents a word in a pulp publication, it takes a lot of words to earn \$20. Let them charge bigger fees for books, and even bigger fees for screenplays that are being produced into movies, but leave writers of features some slack. If you would like to vent your spleen, as

I just did, be sure to talk to the right people—those at the following address: Copyright Office, Library of Congress, Washington, DC 20559.

As you can see, a BBS can also be a good way to blow off steam and let others know how you feel about trends in the field. Let's face it, writing is a solitary profession, but it doesn't have to be lonely if you can reach out and telecommunicate with someone.

Bigger and Better

Commercial online services are the big alternatives to local boards. These are not custom networks, but gigantic groups serving thousands of subscribers with varying interests. As the word *subscriber* suggests, these services cost for membership.

Some examples of such services are DELPHI, CompuServe, Quantum-Link, America Online, GENIE, and BIX (Byte Information eXchange). Each service has its own pricing structure and fees, so a call to each would be a good idea for potential subscribers.

Practically all of the major services have at least one area designated for writers. In some, you post a message as you do on a local BBS and then return in a few days to read the replies. Many services also offer areas for immediate writing discussions. This

Publishers Go Online

Have you ever written an article and then spent months mailing it from publisher to publisher? Now you can submit your manuscripts electronically through a groundbreaking step in publishing by Manuscript Marketing Technologies Incorporated.

MMTI is not like other BBSs and online services. It offers writers a unique opportunity to submit articles or stories which are then offered to publishers electronically. More than 500 authors from all over the world have availed themselves of this service so far, as have 140 publishers from the U.S. and Canada.

Submissions can be made through special software for IBM compatibles which automates the process and records the article or story on disk. Macintosh users can use Microsoft Word format, which is then transferred to ASCII and then into the IBM-compatible program. Manuscripts submitted on paper are scanned through optical character recognition (OCR) software.

Publishers can call MMTI's computer and set the parameters for

what they're looking for in a manuscript. Let's say a publisher needs an article on homeless persons that's about 2000 words long. The publisher specifies the subject, length, and format (article, screenplay, book), and the software displays only those works meeting the criteria. Within the fiction category, there are 26 different parameters, and there are 323 categories in nonfiction.

When a publisher finds an article that meets the criteria, the manuscript can be locked so that no other publisher can get it. The service then gives the publisher information about how to contact the writer. The publisher and writer then work out a deal. Once the two parties come to an agreement, the publisher can download the work into the publisher's computer. Little or no paper changes hands. Only the original disk and contract have to be mailed.

If you're a writer who's spending a fortune on postage in mailing heavy manuscripts from publisher to publisher, this service might be the answer. It's also a good way to make simultaneous submissions for time-sensitive material. Each month, the

writer gets a report of how many times the article was read and why it might have been rejected. This gives the author a chance to judge if the work needs further revision.

The cost is an initial \$25.00 fee and \$10.00 per month. There is a storage charge of \$.0001 per word per day. (A 6000-word piece would run \$1.80 a month.) There is also a \$2.00 fee per disk. When compared to postage to mail the manuscript to 140 publishers, this is a very good deal. (Just sending a query letter to all these publishers would run \$40.60!)

For a full brochure and more information about its services, write to Manuscript Marketing Technologies, P.O. Box 234, Camden, South Carolina 29020. The telephone number is (803) 425-1675.

Remember, MMTI does not act as an agent, and it cannot offer you advice. The company merely offers storage and a distribution service. The software does not handle graphics or photos, but authors can leave a note in the manuscript if photos are available.

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type of system lets you type in a question or comment which is distributed immediately to all of the users who are signed on in the area. In this way, dozens of writers can respond to your comments or questions within seconds.

I host such an area called the Writers' Forum on QuantumLink, the Commodore-specific service. Up to 20 writers meet in realtime once a week in either a lecture or discussion format.

If you still wonder about how an online forum can help you with your writing, here are comments from some of the writers who frequent Q-Link's forum.

"The Writers' Forum keeps me motivated. When I run out of ideas, the group fires me up! It's a great place to talk to people all over the country who share a love of writing," says Marti Paulin.

"If I didn't have the online forum, I'd have to drive 20 miles each way at night to get to my local group," says Cheryl Turney.

"Where else can I talk with people as insane as I am, from all over the country? Seriously, the forum offers me a great place to talk about what a writer goes through, with people who understand," says Eric Lopkin.

"The forum fires my creative

juices—and adds to my degenerate vocabulary," says Donna Carlene.

"It's fun to chat with folks as poor and stubborn as I am," says Alex Tishchenko.

"I enjoy the writing contest. It forces me to come up with things on a regular basis," says Mike Cervini.

Even though I'm a forum leader and editor of "The Writer's Newsletter," I still learn something from speaking with other writers. We've also been fortunate enough to have guest speakers such as Arlan Andrews, Poul Anderson, and Lawrence Block drop in to answer questions and give writing tips. Occasionally an editor such as Eric Lopkin (Lopkin Publishing) or Tom Netsel (COMPUTE's Gazette) will stop by to offer advice. And remember, the Writers' Forum on Q-Link is only one such network. Imagine what joys await you elsewhere. (See "Writers' Forums" for additional information.)

Commissions and Submissions

On the national services, you never know when you might speak with an editor who's looking for someone to write an article, and it could be a topic with which you're familiar. At other times, an online conversation might

spark an idea that could lead to an article or story. This very article was partially queried and updated via E-mail and online meetings on QuantumLink.

Most services have online magazines or areas where you can submit work for others to read. This is also a great way to gain feedback on your writing.

Fiction is popular, and some areas ask you to post articles and nonfiction. Another area of considerable interest is poetry. Here, poets can post their works, and readers are encouraged to leave comments.

Number: 3/26 -Doze with Prose — Poetry

Date: 10:59 p.m. Tues., May 19, 1992

From: Paul #57

Title: More Poetry

Today

I remembered

Our old phone number.

Like a long ago children's rhyme

It came back to me.

I recall phoning late—

On the road, still

To tell you

I'm OK; I'm alive.

Sometimes breathless,

Sometimes angry,

You'd tell me

—hurry home.

A machine tells me that the number

Is disconnected

And I wonder

Who calls you now?

But more,

I wonder

Why I want to

Still.

—Paul May 27, 1990

Into the Future

Computers are the writing tool of the late twentieth century, but networks are playing a major role as writing moves into the twenty-first. If you write with a computer, you owe it to yourself to use this tool as something other than an electronic typewriter. Use it to exchange ideas with other writers, conduct research, submit articles and ideas to publishers, get feedback on your work, and more.

You could never have this amount of power with a typewriter alone, so harness this power and put it to work for you. Writing is an ancient art, but the tools and technology associated with it are still growing. Don't be left behind! □



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KEYDOS VERSION 2

Version 2 of KeyDOS Function ROM for the 128 is similar to DOS for IBM machines in that it lets you change drives easily and defaults to the chosen drive until changed again. KeyDOS ROM is a chip that contains 20 function key definitions and 20 utilities.

It includes Swapper, a utility that lets programmers work on one program in memory, call up KeyDOS to work in another program, and then go back to the original program. There's 1581 Visual Partitioner, RAMDOS, GEOS SuperRBoot, Video Manager, and Hexpert. The main advantage to the KeyDOS program is that it makes it easy to switch drives.

I was happy to find that installation was easy. It took 5 minutes to take the 128's case apart, 2 minutes to install the chip, 15 minutes to vacuum out cat hair—hey, might as well while you're there—and 4 minutes to put the case back together. Subtract 15 minutes from this if you don't own a cat. In other words, this doesn't take long to install, even for a nontechnician like me. On boot-up, the screen will say *HOLD ALT KEY DURING RESET OR SYS 65366 TO ACTIVATE KEYDOS ROM*. Position cursor over the SYS line, hold Alt, and press Return. You'll get a copyright notice from author Randy Winchester and a message telling you that KeyDOS is installed. Here's a list of how KeyDOS programs your function keys and some other changes.

- f1—Load program
- f2—Run program
- f3—Disk catalog
- f4—Run 64 program
- f5—Type SEQ file
- f6—Scratch file
- f7—New active drive
- f8—Scratch and save
- Run—Boot disk/file
- Help—Drive #

The Esc key offers many new commands when used in conjunction with other keys. Commands include Help, a compiler, a 1581 partitioner, a subdirectory key, a batch exec key, GEOS SuperRBoot, CBM RAMDOS, Diskmon, a monitor dump, Hexpert, a drive renumberer, an UNNEW command, a screen

dump, find and replace, an alternate screen, and more. KeyDOS is very useful for running a directory and for running some programs. It's also cool for checking out SEQ files. It allows you to scratch an old file and rewrite a new file in one easy command. If you load it when you first power up, you can examine what's on a disk without loading an extra program.

The program goes downhill from there. I had trouble with the lockups and syntax errors. I needed to reset the 128 almost every third time I attempted different commands. The program includes a demo disk, but it wasn't helpful. It lists nine programs and four sequential files, but I was either denied access or else the 128 locked up whenever I tried to load or run the programs.

Two programs, Write-SEQ-File and Write-List-File, for instance, both tell me that I have no room. I must delete a function key's programming and reprogram a key for these programs, but the manual isn't helpful in telling me how to do this. There are two separate function keys for running 64 and 128 programs. Unless you keep the 64 and 128 programs on separate disks, there's no way of telling a 64 program from a 128 program. Having both types on one disk gives me an error message and forces me to reboot every time I choose the wrong program.

The manual doesn't say which RAM expansion units work with KeyDOS. Since GEOS is the center of my world, I used geoRAM. I tried it and was told to put Desktop 2.0 on the REU, which I had already done. KeyDOS may work with another REU, but not with geoRAM.

Don't worry if programs or files scroll off the screen when a directory is being listed. Go into Utility with Esc-1, and you have a lot of help at your fingertips. KeyDOS has 18 utilities: forward, back, select, unselect, toggle selection, select all, copy, select drive, directory, new disk/list, print, quit, rename, scratch, type, unselect all, 1581 subdirectory, and drive command. Type, for example, sends SEQ files to the screen in PETSCII, true ASCII, and Screen mode.

This utility is great for renaming files, scratching files, and printing

files, but it requires you to call up the directory again. The program doesn't re-display the directory by itself, but this is a small point.

I gave an incorrect command to print, and then realized my printer was not hooked up. The program kept telling me to redo from the start or enter a device number. It would have been handier to default back to the program. As it was, I had to reboot yet again.

The compiler allows you to reassign functions to different function keys. You can save any new configuration to disk and reload it the next time you wish to use it. The 1581 Visual Partitioner lets you not only format a disk but also add a partition to a previously used disk.

The monitor dump sends the monitor output to either a PETSCII disk file or a PETSCII printer. Diskmon and Hexpert should be very useful for machine language programmers.

With KeyDOS you can renumber drives, reset drives, run new collect, rescue a deleted program, execute programs on the alternate screen, install a find/replace/scroll utility, execute a one-drive routine, and run Screen Edit, Clock Manager, and Video Manager.

With Video Manager, you can change the cursor's shape, flash rate, and blink rate. You can use an interlaced monitor, and you can select from 80 colors for text and background. The colors appear only as shades of gray on an RGB monitor. It's also possible to change the background and text to the same color, making the text invisible. This can cause panic city the first time you do it, before you figure out how to undo it. Be prepared for massive button pushing. I had to press f3 at least twice and sometimes three times before I could call up a directory. When I accidentally changed both text and background to the same shade of gray, it took three pushes to change the color. Of course, there's the good old reset button (unless your screen is totally gray). KeyDOS is a specialized product that will appeal to some users more than others. Average users like me probably won't find it as useful as programmers will. If you're a programmer, you'll probably love KeyDOS.

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RISERS AND SLIDERS

Step right up and grab a Slider! Hop on board and take a ride! No, I'm not talking about a new skateboard; I'm talking about a new game from MicroStorm that's called Risers and Sliders.

When I first heard the name, I must admit, the first thing I thought of was the children's game Chutes and Ladders. Then, I booted up the game and discovered a maze that vaguely resembles the mouse-shaped symbol that the Disney channel uses as a logo. Kid stuff, I thought again. However, when I began to play, I quickly saw how wrong I was. This game is definitely not geared to the preschool crowd.

Risers and Sliders is an arcade action game that offers 50 increasingly difficult levels of play. The game's title comes from the red-colored Risers and the blue Sliders that you use to move swiftly around the screen. The Risers move your character up and down; the Sliders move you from side to side. There are also wedge-shaped Sliders that are a cross between the other two transports. They move more or less diagonally on the screen. Of course, you can also walk your character from side to side, but he can't jump or climb. Using combinations of the transports and walking, your goal is to move through the mazes, gather all the diamonds in each, and build up your score.

It's not nearly as easy as it sounds. Learning how to move around takes practice. You have to move your man over the transport and press the fire button while moving the joystick handle in the direction you want to travel. If you have good joystick skills, you'll probably learn the game faster than I did. I have a tendency to overshoot the mark when I'm using a joystick. Do, that in this game, and you'll fall to your death. Even my joystick jockey teenager had to make several attempts before clearing a level.

For one thing, there's the pesky little critters called moths that can sneak up

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on you. They move around the screen unfettered by transports and can pounce rather unexpectedly. Their bite is deadly to you, and you have only three lives to lose. You can evade the moths, or you can attempt to kill them. You do that by smashing them with your transporter. It's worth attempting a kill since you'll earn an extra life if you manage to dispose of 12 of them. You'll also add five points to your score for each one of the moths you eliminate.

Another danger when traveling through the mazes is falling. Be careful where you step! One false step and—BOOM! You've lost a life. In the more advanced mazes you'll also need to know whether or not it's safe to take the diamonds. You'll soon discover how disastrous it can be if you guess wrong. By the way, you get one point for every diamond that you collect. Whenever you earn 200 points, you will get another life.

The screen border helps you keep track of how well you're doing. In addition to the typical score information, the border flashes whenever you earn an extra life. It flashes blue for earning a bonus life on points and red for earning a life for slaying those pesky moths. You'll want to get as many lives as possible because the dangers increase as you advance in the game.

With 50 levels, this game is quite a value. Some levels are complicated; some are deceptively simple. Each has its own dangers. The game's designer, Daniel Lightner, knew how challenging the game was, so he programmed in bonus points for you at the end of every level. You'll get 600 points if you finish a maze in one try, 400 points for two tries, and 200 points for three attempts. If it takes you more than three attempts, you get zip. I played a lot of practice rounds (my name for games in which I died) before I earned any bonuses. Maybe you'll do better. The game will keep you busy for several hours.

That reminds me. Did I mention the clock? Well, that's another little surprise the designer added as a booby trap. You have to complete each of the mazes in five minutes or less. Now five minutes may sound like a lot of time to you, but you'll be surprised how quickly it will pass. Trust me on that. I lost more than one life running around the mazes, avoiding moths, and forgetting about the time. I soon learned to keep a closer watch on my time.

Lightner tried to pack the screens with as many diamonds and obstacles as he could. However, I believe he could have done a better job on the graphics. Risers and Sliders doesn't re-

ally utilize the screen as well as it could have. The transporters are depicted as minuscule squares just a couple of pixels wide. Only their colors designate them as anything special. The moths are a couple of tiny, interconnected loops. The fact that they were moving told me they were supposed to be the deadly moths. Even your character is little more than a stick man that moves. I've seen better graphics on a 64.

The attraction in Risers and Sliders, however, isn't the art. The difficulty of the game is its charm. I suspect once you discover this program, you'll keep coming back for more.

MARTI PAULIN

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programs, a
program
that calculates chess
rankings, and more

Bug-Swatter

Steven Bakke noticed that Fastball (January 1993) highlights the wrong item when he makes a selection from the menu. To correct this problem, load but do not run the program. Then, type **POKE 2133, 201** and press Return. Save this corrected version with another filename.

James T. Jones of Klondike, Texas, points out an error in the April "Programmer's Page." When you run Sequential File Printer, you'll get a **FILE OPEN** error message if you select the Print File option. To correct it, change line 190 to read as follows.

190 PRINT#4,A\$;: GOTO 160

In the May issue, we published a review of Video Digitizer that is distributed by RIO Computers. At the end of the review, we inadvertently published the company's old address. The correct address is RIO Computers, 3310 Berwyck Street, Las Vegas, Nevada 89121; (702) 454-0335. We regret the error.

In "Screen Gems" (May 1993), several readers spotted typographical errors in various program listings. Bill Gisonda of Bethpage, New York, noted that lines 230 and 240 of Brownian Symmetry should be numbered 250 and 260 respectively. Also, lines 150 and 230 should read as follows.

**150 IF Y > 100 THEN 80
230 DRAW, (160-X)/N, 100-Y**

Donald Klich of Mount Prospect, Illinois, spotted other typos, which just goes to show what can happen when typesetters have to enter listings without the aid of The Automatic Proofreader. Curve Explosion would look better if line

10 were entered as follows.

**10 COLOR 1,2: COLOR 0,1:
COLOR 4,1**

In Trig Show, lines 270 and 280 had some problems with an extra colon and a missing Return. The lines should read as follows.

**270 IF BB=0 THEN DRAW ,
X*25.5,100-FNY(X)*30
280 NEXT: WAIT 212,1:
RETURN**

In January 1993, we printed a request from a 128 user in Syria who would like to correspond with other Commodore users around the world. Here is his correct address.

Ahmad Husam Mukhalalati
P.O. Box 10392
Aleppo, Syria

Chess Ranking

I would like to start a chess club, and I have been looking for a program that calculates club members' chess rankings. Could you give me some help with a program?

VINCENT SULEWSKI
SOUTH HADLEY, MA

Here is a simple program that calculates rankings after players have completed either one or a series of games. As players compete, they should keep track of the number of games they play; their opponents' rankings; and their overall score for wins, ties, and losses.

```
AS 10 PRINT "{CLR}"
GX 20 INPUT "NUMBER OF GAMES PLAYED";G
MF 30 DEFNFX(X)=(99↑(X/800))/(1+(99↑(X/800)))
:REM{2 SPACES}RATING FORMULA
PX 40 INPUT "YOUR RATING";R
KA 50 PRINT "OPPONENTS' RATINGS?"
CE 60 FORB=1TOG
KE 70 INPUT O
CP 80 X=R-O
FP 90 IF X<-800 THEN X=-800
```

```
ED 100 D=D+FNF(X)
GH 110 NEXT
RB 120 INPUT "YOUR SCORE";S:S=S-D
DR 130 IF R<2100 THEN 170
JD 140 IF R<2400 THEN 160
JP 150 S=S*16:GOTO 220
MP 160 S=S*24:GOTO 220
HM 170 S=S*32:IF R+S+.5>INT(2099) THEN 220
MM 180 IF G<4 THEN G=4
XH 190 IF S>32+(3*(G-4))AND R+S+(32+(3*(G-4)))<2100 THEN 210
KS 200 GOTO220
HJ 210 R=R+S+S-(32+(3*(G-4))):GOTO230
GC 220 R=R+S
GE 230 PRINT:PRINT"YOUR NEW RATING IS";INT(R+.5)
EE 240 PRINT:PRINT"AGAIN?"
HQ 250 GET A$: IF A$="" THEN 250
RA 260 IF A$<>"Y" THEN EN
CD 270 GOTO10
```

A full-featured chess ranking calculator that keeps track of an entire club's standings would be too large to supply here. If a chess fan who programs would like to submit an original program, we'll consider it for publication in the "Programs" section.

Scratched Commas

In the March 1993 "Feedback," you told how to scratch a filename that appeared in a disk directory as a comma. Your methods are fine, but there is a much simpler method. Simply enter the following line.

OPEN15,8,15."S0?":CLOSE15

This question mark wildcard will erase any file whose name consists of but a single character.

AL WILDERMUTH
RIVERSIDE, CA

Thanks to Al and all the other readers who replied with this simple solution that slipped Gazette's collective mind. Just check the directory first to see if there are any single-

character files on that disk that you wish to retain. If so, rename them before deleting.

Interest Calculations

As an active participant in IRA distributions, I was very interested in IRA Minimum Distributions (April 1993). I was attracted to lines 980, 990, and 1000 where the interest calculations take place.

Years ago, I got involved in interest calculations, especially after I read in a mathematical journal that it was impossible to calculate daily compound interest (yield) except by the one-day-at-a-time method, as used in the article.

As an engineer, I find the word *impossible* to be incomprehensible, so I devised a means for making long-term calculations easy. As published, the calculation for a sample 20-year projection and its 20-year payout schedule takes nine minutes and 42 seconds. With my revision, the same calculation takes only 7 seconds.

Insert REM after line numbers 980, 990, and 1000 to preserve the original code and then enter this line.

```
985 SP=SP*EXP(1)↑(365.25
*LOG(1+R/365.25))+.001:
SP=INT(SP*100)/100:
RETURN
```

The 365.25 allows for the extra day in a Leap Year.

LES WILLIS
DELAND, FL

Machine Language

Over the years, your magazine has carried a column for machine language programming; however, I haven't seen any instructions on how to actually implement the information. Is a special program required?

EARL WOODMAN
DILDO, NF
CANADA

When you start learning machine language, the first thing you need is an assembler. An assembler is to machine language what the BASIC programming language is to programming in BASIC. It translates your commands into numbers that the computer can understand and use.

Since it's difficult to write a program entirely in numbers, an assembler replaces the sequence of numbers with standardized mnemonics, commands that humans can more easily remember and understand. Here's an example.

```
10 * = 880
20 LDA #147
30 JSR 65490 40 RTS
```

In this short program, when you enter SYS 880, the computer's screen clears. The 147 is the number which clears the screen. LDA is a mnemonic that means Load the Accumulator, a special area in the computer. So 147 goes into the accumulator, and the program moves on to the next instruction. JSR means that the program then Jumps to Subroutine at 65490, which is the address in ROM which prints whatever character is currently in the accumulator. The screen clears, and the program moves on to RTS. This command, Return from Subroutine, causes the computer to leave machine language and return to BASIC.

This program is called source code, but you cannot run it as you would a BASIC program. The assembler takes this code and turns it into object code, poking numbers 169, 147, 32, 210, 255, and 96 into memory locations 880-885.

The computer doesn't have any idea what to do with LDA, but when LDA is converted into 169, it knows

to load the accumulator. It's also easier to remember LDA than 169. The 32 means JSR, 210 and 255 is a two-byte address that represents 65490, and 96 returns the computer to BASIC (RTS).

For those who don't have an assembler, we often print the code in the form of a BASIC loader. The computer's ML instructions are in the DATA statements.

```
10 FOR A = 880 TO 885
20 READ D: POKEA,D
30 NEXT
40 SYS 880
50 DATA 169,147,32,210,255,96
```

As with most Commodore software, finding a good commercial assembler such as Commodore Macro Assembler, Buddy 64, or Merlin64 may be difficult these days, but a number of public domain programs are available. Gazette's own BASSEM (April and May 1990) is still available on the Best of Gazette Utilities Disk (\$13.95).

Resume Typing

I have some suggestions which might help Jack Christlaw, who was having difficulty entering programs in one typing session.

Whenever I wish to stop typing, I save what I have using the number of the next BASIC or ML line of code as the filename. This assures that I'll never use the same filename twice and I'll always know where to begin again. I also always use a fresh disk with only MLX or Proofreader on it.

ARNOLD JONES
STONE RIDGE, NY

Send your questions and comments to Gazette Feedback, COMPUTE Publications, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. □

A question about machine language, and a tip about saving partial programs

PD PICKS

Steve Vander Ark

MISCHIEVOUS 64 AND MORE

QuantumLink isn't the only place to find shareware and public domain files, but it's probably the *best* place. Q-Link has more files than anybody else—plain and simple.

I have a copy of its catalog of files, a burly tome close to two inches thick and heavy enough to keep the door to my computer room shut against my one-year-old. This hernia-inducer makes a valiant effort to list all 35,000 of Q-Link's programs and files. Yes, *35,000!* Make no mistake; if you're serious about your Commodore, you belong on the Q.

If you aren't a Q-Linker, though, you can find good PD programs on any BBS that supports the Commodore. The Rogue River BBS in Grand Rapids, Michigan, has all the files mentioned in this column. The phone number is (616) 361-8267. Of course, all programs mentioned here are also on Gazette Disk. Here are my PD picks for this month.

Mille Bornes

Original author unknown.
QuantumLink filename: MILLE BORNES.3; uploaded by RolfB.

I seldom play Mille Bornes. My wife and I bought it about ten years ago, and it's a great game. The problem is that I play it for blood, which is the way my wife plays Monopoly. That's why we don't play Monopoly either. So when I found this one-player card program buried in the 64 games section of Q-Link, I got all excited. Now I could stomp someone at Mille Bornes without having to sleep on the couch!

This version of Mille Bornes isn't glamorous. It's entirely text with gameplay true to the original. You take turns with

the computer, playing or discarding cards from your hand, trying to accumulate distance toward a goal of 1000 miles. Along the way you play cards against the computer's hand and try to inflict your opponent with all sorts of calamities, including flat tires and accidents. You see where attitude can creep into the game.

According to comments posted on Q-Link about this game, some of its more obscure rules aren't supported in this version. I wouldn't know, since I don't play the original enough to remember any of the more obscure rules! All I know is that this little gem of a game is addicting.

The computer is a bland adversary, of course. I miss the scowl I used to get from my wife when I would gleefully slap down an accident card. She doesn't play Mille Bornes on our 128 much. She's too busy playing Monopoly on the IBM.

Maximum Overdrive

By Dan Komaromi.

QuantumLink filename: OVERDRIVE; uploaded by DigiDan.

I'm not sure what category to put this piece of programming genius into—it's certainly not a game. But what the heck: Here it is, and it's absolutely my favorite 64 download of all time. Like I just said, it's not a game. It's not a utility either, really. It doesn't exactly keep you glued to your monitor; in fact, it works the best when you aren't even around.

Let me explain. Maximum Overdrive is the sneakiest bucket of surprises you'll ever dump on your unsuspecting 64. When you first run it, you are presented with a menu of interesting-sounding options. Once you make your choice, your beloved Commodore computer disappears and is replaced by nothing less than its

evil twin. Oh, it looks just fine—same blue screen, same friendly blinking cursor, same everything. But, oh, what horrors lurk within!

For example, when you enter an innocent LOAD command, the computer might snap back with *LOAD IT YOURSELF!* With another setting, your usually complacent 64 reacts to a keypress by snarling that it's trying to sleep. It then turns off its monitor.

There's a startlingly impressive self-destruct mode which really grabs your attention if you have the volume cranked up. There's even an option which looks for all the world like you've accidentally connected with NORAD computers somewhere and have launched a few missiles.

The author, who calls himself DigiDan on Q-Link, has had his programs published in several magazines, and his expertise shows in the slick interface as well as in the nifty screen tricks. He includes some extra touches, such as allowing you to disable the Run/Stop key and type in your own bits of nastiness for the Insult section. Komaromi employs some excellent raster interrupt effects, a good dose of SID chip sound magic, and an oversized helping of cleverness to make your 64 go off its electronic rocker.

The general idea is to set up your computer with one of these fake startup screens when you are going to be away from your keyboard. Should some unsuspecting victims try to use it, they'll be left wondering how they managed to make the whole system go kablooie when they just typed a simple command. I'm not sure why I like this program so much because I don't have anyone to pull these tricks on, but I get a bang out of watching them run.

I know. Get a life! □

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MACHINE LANGUAGE

Jim Butterfield

FILE-END TRIMMER

Last time, we learned that a file that ends with more than one return can cause trouble when used with the BASIC INPUT# statement. Now, let's write a program to detect and correct this problem.

A BASIC program will poke the ML code into place. Phase 1 then checks the file, and phase 2 copies the file, chopping any extra returns.

The detection phase uses a brief ML program at \$2200, decimal 8704. The file is corrected, if needed, by a longer ML program at \$2217, decimal 8727. This is the code we'll examine here.

File-copying programs must deal with ST, the status word, found at address \$90. We must read the ST value right after we reference a file so that it won't be changed by some other file activity.

Our program reads from one file and writes to another. We must check ST (for end-of-file) after each read. We have an input character to dispose of, so we may need to write to the output file before we act on the end-of-file signal.

We'll test ST right after performing an input and push the test results to the stack. Later, we'll act on those results.

Here's a second puzzle. Our task is to remove extra return characters from the file end. But, as we read the file, we don't know if we're near the end. We must not copy returns until we know it's safe.

When we read a return character from the input stream, we won't output it. We'll count it, using location \$2100 as a counter. If we find more text, we'll output the correct number of returns before continuing. I'll comment on selected parts of the program.

Initial code zeroes the counter at \$2217. We enter the main read loop, and the input

stream switches to logical file 1.

We grab a character and test the ST variable, pushing the result to the stack with PHP.

```
2221 JSR $FFE4
      LDY $90
      PHP
```

We skip ahead if we didn't get a return. Return needs special work: We count it and then check to see if we're at the end of the input file. That information is on the stack, remember? If we're not at end-of-file, we keep reading.

```
CMP #$0D
BNE $2237
INC $2100
PLP
BEQ $2221
```

If it's a return at the end of the file, we push the test results back on the stack and zero the counter to get rid of the excess returns.

```
PHP
LDY #$00
STY $2100
```

The program reaches \$2237. Either we've received a character (still in the A register) which is not a return, or we're at end-of-file. Push the input character to the stack, disconnect the input stream, and hook the output stream to logical file 2.

```
2237 PHA
      JSR $FFFC
      LDX $02
      JSR $FFC9
```

Is the return counter 0? If so, skip the next bit.

```
LDX $2100
BEQ $2250
```

Location \$2245 sends the returns using a loop. We'll omit that code. The next step outputs the character that was

received.

```
2250 PLA
      JSR $FFD2
      JSR $FFCC
```

We check the end-of-input condition, still on the stack. We either loop or quit.

```
PLP
BEQ $221C
RTS
```

Here's the whole program in the form of a BASIC loader.

```
ES 100 PRINT "FILE END TRIMMER
- JIM BUTTERFIELD"
XR 110 DATA 162,1,32,198,255,1
59,0,141,0,33,32,228,25
5
GS 120 DATA 164,144,240,246,14
1,1,33,76,204,255
AQ 130 DATA 169,0,141,0,33,162
,1,32,198,255
HQ 140 DATA 32,228,255,164,144
,8,201,13,208,12
HM 150 DATA 238,0,33,40,240,24
0,8,160,0,140,0,33
PC 160 DATA 72,32,204,255,162,
2,32,201,255,174,0,33
RX 170 DATA 240,11,169,13,32,2
10,255,202,208,248,142,
0,33
KH 180 DATA 104,32,210,255,32,
204,255,40,240,194,96
RS 200 FOR J=8704 TO 8794
EJ 210 READ X:T=T+X
BP 220 POKE J,X
AE 230 NEXT J
SG 240 IF T<>11245 THEN STOP
XF 300 INPUT "NAME OF FILE";FS
JQ 310 OPEN 15,8,15
FJ 320 OPEN 1,8,2,FS
GB 330 INPUT#15,E,ES:IF E<>0 T
HEN PRINT ES:STOP
QH 340 SYS 8704
SB 350 CLOSE 1
SD 360 CLOSE 15
GC 370 IF PEEK(8449)<>13 THEN
{SPACE}PRINT "FILE DOES
NOT END WITH <RETURN>."
":END
SE 380 IF PEEK(8448)<>13 THEN
{SPACE}PRINT "FILE ENDS
WITH A SINGLE <RETURN>."
":END
XS 390 PRINT "FILE ENDS WITH M
ULTIPLE <RETURN> CHARS."
":END
XB 400 INPUT "SHOULD I CLEAN I
T UP?";XS
HF 410 XS=LEFT$(XS,1)
AF 420 IF XS<>"Y" THEN END
AD 430 INPUT "NAME OF REVISED
{SPACE}FILE";RS
AH 440 OPEN 15,8,15
DS 450 OPEN 2,8,3,"0:"&RS+"&S,
W"
MK 460 INPUT#15,E,ES:IF E<>0 T
HEN PRINT ES:STOP
PF 470 OPEN 1,8,2,FS
CP 480 INPUT#15,E,ES:IF E<>0 T
HEN PRINT ES:STOP
QE 490 SYS 8727
QM 500 CLOSE 1
PP 510 CLOSE 2
EQ 520 CLOSE 15
```

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with BASIC's INPUT#
statement and
chop any extra
Returns that
may cause a crash.

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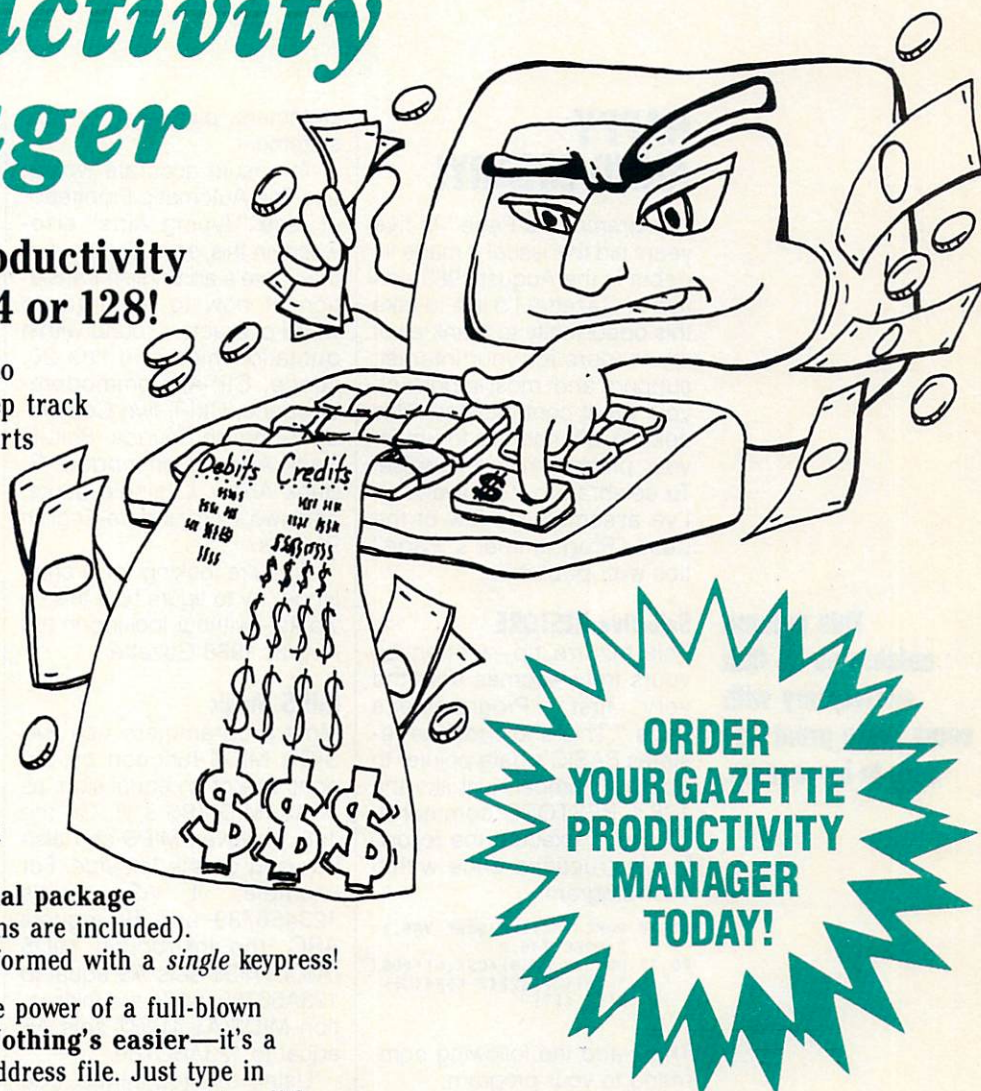
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PROGRAMMER'S PAGE

Randy Thompson

HAPPY ANNIVERSARY!

"Programmer's Page" is five years old this issue! It made its debut in the August 1988 edition of Gazette. I'd like to take this opportunity to thank all of my readers for your interest; support; and, most important, your great contributions. This column, after all, is a forum for your programming expertise. To celebrate our anniversary, I've assembled a few of the best "Programmer's Page" tips ever published.

This column celebrates its fifth anniversary with some more great tips sent in by readers.

Selective RESTORE

This bizarre tip—written by yours truly—comes from the very first "Programmer's Page." This short routine restores BASIC's data pointer to any line number, just like the 128's RESTORE command. To use it, execute the following instructions once within your program.

```
BD 10 POKE 784,108:POKE 785,12
      2:POKE 786,0
PQ 20 DEF FN RS(N)=USR(N)+POS(
      " {A}{U}{T}{E}{F}{G}{
      L' {2 E}")
```

Then, add the following command to your program.

X=FN RS(line number)

In this case, *line number* is the line number of the DATA statement at which you want your program to READ. In other words, RESTORE to this line. The line number can be a number, variable, or even an expression such as 1000+I*10. If you want, you can replace X with a variable. Just be warned that the value of the variable used will be scrambled.

Be especially careful when entering line 20. A single typo could cause the computer to lock up when the program is run. Note that there are no spaces between the USR

statement, plus sign, or POS statement.

To ensure accurate typing, use The Automatic Proofreader; see "Typing Aids" elsewhere in this issue. To help further, here's an English translation of how to enter those weird characters found within quotation marks in line 20: space, Ctrl-A, Commodore-U, space, Ctrl-T, two Commodore-English Pounds, Shift-F, Back Arrow, Commodore-G, Back Arrow, L, single quote, and two Commodore-English Pounds.

If you're looking for a challenge, try to figure how this tip works—without looking in the August 1988 Gazette.

MID\$ Magic

Most programmers use BASIC's MID\$ function on the right side of an equal sign, as in A\$=MID\$(B\$,3,1). On the 128, however, MID\$ can also be used on the left side. For example, if A\$ equals 123456789 and B\$ equals ABC, the instruction MID\$(A\$,4,1)=B\$ sets A\$ equal to 123A56789, while the instruction MID\$(A\$,4)=B\$ sets A\$ equal to 123ABC789.

Using this technique, you can stuff one character or a group of characters into the middle of another string without juggling LEFT\$ and RIGHT\$ functions. Credit for this useful string-handling advice goes to Michael Verdiguil of Lawton, Oklahoma.

Unscrollable Lines

Here's a short machine language subroutine from Sean Ganess of Woodside, New York, that protects the top two lines from being scrolled off the screen. You can still print text to these lines and erase them by clearing the screen, but they are unaffected by scrolling text. You might want to use this feature to display such things as your location

in an adventure game or to show the disk drive status in a utility program.

```
FR 10 GOSUB 3000:END
GF 3000 FOR I=828 TO 875:READ
      {SPACE}D:POKE I,D:C=C+
      D:NEXT
XK 3010 IF C<>6370 THEN PRINT
      {SPACE}"ERROR IN DATA
      {SPACE}STATEMENTS":END
CF 3020 SYS 828:POKE 59639,1:P
      OKE 64982,53:POKE 1,53
HQ 3030 RETURN
FJ 3040 DATA 160,0,132,38,169,
      224,133,39,177,38,145,
      38,200,208,249,230,39,
      165
QA 3050 DATA 39,201,0,208,241,
      160,0,132,38,169,160,1
      33,39,177,38,145,38,20
      0,208
KJ 3060 DATA 249,230,39,165,39
      ,201,192,208,241,96,0
```

To use this program, simply GOSUB 3000 whenever you want to protect the top two screen lines. This subroutine needs to be executed only once when your program is first run.

Missing Data

Neglecting to put numeric data between the commas in a DATA statement is the same as including the digit 0. For example, check out the following program.

```
10 FOR I=1 TO 10: READ D:
   PRINT D:NEXT
20 DATA ,,,,,,,,
```

Line 20 produces the same results as the following.

```
20 DATA 0,0,0,0,0,0,0,0,0,0
```

If you are reading string data—as in the command READ D\$—the missing data is interpreted as a null string. This tip came courtesy of Doug Ross of Merrickville, Ontario, Canada.

Send your programming tips to Programmer's Page, COMPUTE's Gazette, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. We pay \$25-\$50 for each tip that we publish. □

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BEGINNER BASIC

Larry Cotton

BUCKS IN A POT

Let's get back to reviewing BASIC statements, specifically FOR-NEXT loops. Here's a quick review. FOR-NEXT (or FOR/TO/STEP/NEXT as the *Commodore 128 Programmer's Reference Guide* calls it) executes repetitive loops.

We've seen how each FOR-NEXT loop requires seven separate and distinct elements and how STEP can be less than 1, more than 1, or a negative value. (Omitting STEP yields a step size of +1.) Here are some simple examples.

```
10 FOR J = 1 TO 4
20 PRINT J
30 NEXT
```

```
10 FOR J = .5 TO 3.5 STEP .5
20 PRINT J
30 NEXT
```

```
10 FOR J = 10 TO 1 STEP -2
20 PRINT J
30 NEXT
```

A very common use for FOR-NEXT is to load arrays. We've studied arrays in this column before, but if you don't understand or remember them, we'll get back to them soon. For now, just think of an array as a group of pigeonholes that need numbers stuffed into them. The pigeonholes usually have names such as A(1) or B(4). Here's how to fill a small one-dimensional array using a FOR-NEXT loop.

```
10 FOR J = 1 TO 10
20 A(J) = 25
30 NEXT
```

This simple pigeonhole stuffer will make each variable A(1) through A(10) equal to 25. Here's how you can make the variables equal the counter as it's increased.

```
10 FOR J = 1 TO 10
```

```
20 A(J) = J
30 NEXT
```

You can read DATA statements and place them into the arrays, too.

```
10 FOR J = 1 TO 7
20 READ Q
30 A(J) = Q
40 NEXT
50 DATA 12, 2, 52, 41, -3, 3.5,
-7.34
```

After this program runs, A(1) will be 12, A(5) will be -3, and so on.

Let's take another look now at nested FOR-NEXT loops. Here's an example.

```
10 FOR A = 1 TO 3
20 FOR B = 3 TO 4
30 PRINT "A="A,"B="B
40 NEXT B
50 NEXT A
```

The A loop is the outer one, and it loops a total of three times. The B loop is the inner one, and it loops twice for each value of A. The use of the variable names after NEXT is optional, but it can help keep things straight.

Now, let's get to the meat of this month's column. The other day, a friend called to ask for help with his third-grade son Derek's homework.

The problem, as we understood it, was to calculate how many combinations of twenties, tens, and fives could be in a pot of \$200. Naturally, I don't need much inspiration to write a BASIC program. So I wrote one to solve the problem, and it just happened to use nested FOR-NEXT loops. Here it is.

```
10 PRINTCHR$(147)
20 INPUT"HOW MUCH IS IN THE
POT";P
30 TW=P/20
40 FORI=0 TO TW
50 R=P-I*20
60 TE=R/10
```

```
70 FORJ=0 TO TE
80 C=C+1
90 NEXTJ
100 NEXTI
110 PRINT:PRINT"THE
ARE"C"COMBINATIONS."
```

Line 20 asks the user for a pot value. Enter the number only, not a dollar sign. Line 30 finds the maximum number of twenties (TW) which can be in the pot. Then we start a loop in line 40 which counts up from no twenties to TW.

Lines 50 and 60 calculate the maximum number of tens there can be in the pot for any given number of twenties. Our inner loop (J) begins at line 70 and counts up from no tens to the maximum number of tens for each value of I, the twenties counter.

Inside the inner FOR-NEXT loop is another counter (C in line 80) which simply increments every time the inner loop is used. For each number of tens for a given number of twenties, there will be a certain number of fives necessary to arrive at the total pot. Therefore, we've counted all the possible combinations!

If there were ones in the pot, you would need another FOR-NEXT loop which would increment (or decrement) the fives while holding the twenties and tens constant. The number of combinations would become staggering.

This seemed like a tough problem for a third-grader to solve. We discovered later that the actual assignment was to find just *some* of the possible combinations—not all of them! Anyway, it was an interesting problem and a good excuse to write a BASIC program. By the way, there are 121 possible combinations of twenties, tens, and fives in a pot of \$200. With larger pots, watch the time it takes to calculate the combinations grow exponentially. □

How many combinations of fives, tens, and twenties can you find that will total \$200?

Steve Vander Ark

IMPORTING GEOS GRAPHICS

Two of my favorite subjects are graphics and geoPublish, and last month I talked about both. I described differences between geoPaint's bitmapped graphics and geoPublish's object-based ones.

This fundamental difference between the two formats is important for you to understand, lest you find yourself confused and frustrated. Once you get the hang of object-based graphics, though, you'll love the freedom that they give you to experiment and to create.

Working with geoPublish, you'll most likely want to use clip art with your documents. Most of this art will be in bitmap format, which means that it's stored as a fixed set of dots laid out to form an image. This graphics don't use the same format as those created by geoPublish itself, but that doesn't mean that you can't use them. You can import these bitmaps very easily.

Each mode of geoPublish has an import tool. In both Page Graphics and Master Page modes, the bitmap appears where you click the cross hairs on the page. Once imported, the bitmap is an object on its own layer, just like any other object on the page. Remember, if you enlarge this image, you won't be adding more dots to the image; you'll only be making the existing dots bigger. As a result, an enlarged bitmap looks blocky and jaggy. GeoPublish offers a smoothing option which helps by rounding off some of the sharp edges, but this doesn't always make it look better.

In Page Layout mode things work a little differently. You can still resize an image and change its attributes, but

the way you move a bitmap onto your page is unique to this mode. In Page Layout mode you create rectangular areas (regions) on the page in which to place text or, in this case, bitmaps. Before you can import an image, you must define an area in which the image will be located. This region can contain only the graphic or text file you specify for it. If you place a region on top of another region, you won't be able to see through the one on top. And if you place the region on top of a text region, the text will adjust around it.

This is very useful for mixing text and graphics on a page. You can create a large text region, then create graphics regions on top where you want the bitmaps to appear. The text will flow around those regions as pretty as you please.

In Page Graphics mode, however, if you place a graphic in the middle of a text area, the two will just overlap. This also can be a useful technique if you change the pattern of the bitmap to gray instead of black, allowing the text to stand out. But if you want text to flow around graphics, you'll want to import those graphics in Page Layout mode.

Remember that I said that the regions you create in Page Layout mode are rectangular. The text will flow around that rectangular area, not around the edges of the image itself. There's no built-in way to make text flow around an irregular edge. You can simulate this effect by creating a number of text regions, each sized to hold a few lines of text and each fitted to the edges of the graphic image. The problem occurs if your graphic was imported in Page Layout mode. This mode won't let you cross its straight region edges with your text regions.

If you import the image in Page Graphics mode it won't be visible in Page Layout mode at all, which means it'll be next to impossible to fit a text region next to it with any precision. Probably the easiest way to simulate text flowing around an irregular graphic is to create text which has a built-in flow created by pressing the Return key at the end of the lines in strategic places, then fitting the graphic to it in Page Graphics mode.

There is one other way to get graphics onto your geoPublish page. You can first import them into a geoWrite document which you then import into your geoPublish document. The graphic gets imported as well as the words. It even keeps its formatting within that text area (centered, for example). This method works particularly well if you want the graphics to be tied to the text, such as in a fancy headline or a letterhead. Of course, you're stuck with geoWrite's rather limited photo scrap size.

Let's think bigger for a minute. It can be a bit of a hassle to import photo scraps when they're limited to the size of the geoPaint window. There are utility programs which will let you clip photo scraps as large as an entire page. One of the best, called Scrap Can, comes as a bonus on the geoCanvas disk from Creative Micro Designs. A shareware example is Scrap It (Q-Link filename: SCRAP IT, uploaded by TerryV7). These utilities will in effect let you convert an entire geoPaint page into a geoPublish page, although the whole thing is then a single large object. You can also convert a geoPublish page from a series of layered objects into a large bitmap (in other words, convert it into a geoPaint document) with the program Paint Pages, which comes in the GEOS 2.0 package. □

Get the most from geoPublish by importing bitmapped graphics and clip art.

D'IVERIONS

Fred D'Ignazio

MULTIMEDIA ROAD WARRIOR

My name is Fred D'Ignazio, but most people know me as the Road Warrior. For the past ten years, I've journeyed to more than 100 school districts in North America, Europe, and Australia as a multimedia evangelist—a Johnny Appleseed of new technology.

My mission began in the mid-1980s in a kindergarten classroom in Cahaba Heights, Alabama. I had conceived a concept of classroom learning known as the multimedia sandbox. Children and teachers in the sandboxes scavenged common items from around their schools such as a computer, a tape recorder, a record player, a tiny musical keyboard, a VCR, a TV, a camera, and so on. I then taught them how to use \$5 Radio Shack cables to connect these items into a children's multimedia publishing center.

The idea caught on like wildfire in the Jefferson County, Alabama, schools. Pretty soon we had 13 multimedia sandbox schools and almost 100 children, parents, and teachers who were learning to assemble, troubleshoot, and operate these scavenged multimedia workstations.

In early 1986 I was invited as a featured speaker to one of the foremost national conferences for computer-using educators. To prepare for the national debut of the multimedia sandbox, I asked the conference organizers for the basic elements of a scavenged workstation (a computer, VCR, camcorder, and so on) along with presentation devices such as a video projector and a speaker system for a room full of hundreds of adults. I arrived at the conference fully expecting all the equipment to

be assembled for me. After all, the Jefferson County kids and teachers had mucked around with this stuff for months.

Boy, was I surprised! None of my stuff was ready. Technicians were scratching their heads and telling me that it was impossible to plug a computer's video-out jack into a VCR and that it was not appropriate to use a common tape recorder as an audio input device for a VCR. There were none of the Radio Shack cables and adapters that I required to integrate the little devices into a multimedia workstation.

But I toughed it out. I reassured everyone that such things were being done every day by five-, six-, and seven-year-olds in Alabama. Then, I rushed out of the hotel and ran across town to a Radio Shack and quickly purchased \$25 worth of cables and adapters.

Back at the conference hotel, I hurriedly plugged cables to the equipment and computer. A short time later, hundreds of people arrived for the demonstration of my multimedia sandbox. I turned on the video projector. Uh-oh! The bulb burnt out. I turned on the large speaker that the hotel had provided for my sound system. No sound. No one could hear or see my stuff.

I'd brought an hour's worth of videotapes and computer slides created by the Alabama children on their scavenged multimedia workstations. They included multimedia story problems for math class; multimedia book reports and biographies; and multimedia science projects featuring animated black holes, beating hearts, and dancing skeletons. I also had a wonderful presentation by a team of kindergartners and sixth-graders titled "What Is a Principal?"

I couldn't show any of it. I was stunned. What had be-

come simple for us in my kindergarten classroom in rural Alabama was impossible to demonstrate in a world-class technology conference in one of America's largest cities.

I survived that experience by calling my audience to the front of the room to see my stuff on a little TV and computer screen and to listen carefully to the puny sounds coming out of my portable speaker.

That's the day I first became a multimedia Road Warrior. I vowed that I would never be caught off guard again.

Since then, I've traveled with all of my multimedia supplies squashed into four durable Road Warrior bags. I carry the two smaller ones on board each plane and check the two larger bags. If the two larger bags don't show up at my destination, I can do a "Multimedia Lite" presentation with the cables and stuff from the two carry-on bags. If I'm fortunate and the airlines doesn't lose the two bags that I've checked, I can put on a whiz-bang "Multimedia Classic" presentation full of rocket ships blasting off, kindergartners' digital videos, and New Age music composed by deaf children.

So if you're in an airport in the coming months, watch for me. I'm the small bearded man, rushing from one airport gate to the next, carrying two small duffel bags, trailing green and red Radio Shack cables, and spilling stacks of CD-ROMs and disks on the floor behind me.

It's a dirty, sweaty job, but some day, people will look at their gleaming multimedia TVs and remember the early days of multimedia, back to the days of spaghetti-like cables, the multimedia boxes that never seemed to work together. If you jog their memories, they may even recall a little man with a vision—the guy they called the Road Warrior. □

Who is that little guy rushing through airports with duffel bags stuffed with more parts than a small electronics store?

32 SPRITES

By Bill Soudan

As far as games go, most 64 users are aware that they normally are limited to having eight sprites (or MOBs, Movable Object Blocks) to manipulate. There are programs, however, that can double or even triple the eight-sprite limit, but these programs often impose restrictions or cause annoying flicker—making the extra sprites almost worthless.

Thirty-two Sprites lets you quadruple the 64's sprite limit without losing any flexibility, while keeping flicker to the barest minimum. Thirty-two Sprites can handle up to 32 sprites at a time, and each sprite can be placed anywhere on the screen!

Thirty-two Sprites is a BASIC program that lets you create a customized machine language routine for up to 32 sprites. To help avoid typing errors, enter 32 Sprites with The Automatic Proofreader; see "Typing Aids" elsewhere in this section. Be sure to save a copy of the program before you run it.

Getting Started

Load and run 32 Sprites. After a short pause, a main menu will come up. This is where you can customize almost every aspect of 32 Sprites. To change an item on the menu, type in the number in front of the parameter you want to change and press Return. If the parameter can be turned on and off, the program will first prompt you for the desired setting. Next, the program will ask you the new memory location. You can enter the new location in either hex (by preceding it with a dollar sign) or in decimal. You may simply press Return if you wish to leave the program at its default location.

Menu Selections

The first item in the menu is Starting Address. This simply specifies the memory location where the machine language code for 32 Sprites will begin in memory. The next eight menu items correspond to the computer's sprite registers. Each of these can be turned on or off, and each can also place the shadow registers anywhere in memory.

Because there are only enough registers in the VIC chip for eight sprites, 32 Sprites must set aside a section of

memory to handle 32 sprites. The hex and decimal addresses listed next to each of the sprite parameters indicate where in memory the shadow registers of that particular parameter will start.

You can place these shadow registers anywhere in memory. For example, the default Y position shadow registers start at 52992 (\$CF00). To change sprite 1's Y position, simply poke 52992 (\$CF00) with the desired Y position. Each consecutive memory location controls the next consecutive sprite number. To change sprite 2's Y position, poke 52993 (\$CF01) with the desired number. This continues to location 53023 (\$CF1F), which controls sprite 32's Y position.

Temp Page

The next menu item is Temp Page. This is a workspace in memory, 256 bytes long, required to sort the sprites from the least Y position to the greatest Y position. All 256 bytes are used, and this area of memory should not be used by any other program.

Order Table

Order Table is the next menu item. This is a 32-byte area needed by 32 Sprites to hold the order of the sprites after they are sorted.

Extra Y Table

Because 32 Sprites uses interrupts to function, changing a sprite's Y position while the VIC chip is drawing will cause that particular sprite to flicker and possibly will cause other sprites to flicker as well. The Extra Y Table is a copy of the Y position shadow registers, and it is used by the interrupt routine to prevent flicker. Again, this 32-byte area should not be used.

How Many Sprites?

The last menu item lets you determine the maximum number of movable object blocks or sprites that you want to use at one time. This number can be changed to 16, 24, or 32. Note that changing this register changes the length of the shadow registers. If 32 Sprites is set to 16 sprites, only 16 shadow registers are needed. This should always be set to the maximum number of sprites which you plan to use in your program.

Generating 32 Sprites

After you've set the parameters for your sprites, it's time to generate 32 Sprites, which is a machine language routine. This is item 14 on the menu.

A minute or two after selecting this option, the program will generate the code and supply you with its starting and ending addresses in both decimal and hex and with information on how to enable and disable 32 Sprites. The program will ask you if you'd like to save the ML routine to disk. Respond with Y or N.

If you wish to save 32 Sprites to disk, press Y and the program will prompt you for a filename. Type in your choice of a filename and hit Return. Make sure a disk is in the drive. Be careful because the program doesn't check for disk errors.

After the program is saved or after pressing N at the save prompt, the program will ask if you want to print an information sheet. The info sheet is simply a listing of the starting and ending addresses of the ML routine; the SYS addresses that enable and disable 32 Sprites; and a copy of the main menu parameters, with the on/off status and address. If you'd like a copy, turn on your printer and press Y. Once the print-out is completed or after hitting N, the program will clear the screen and end. The 32 Sprites machine language is now in memory and ready to be used.

Your Own Programs

With 32 Sprites, you can now write your own BASIC programs that contain up to 32 sprites. Before calling the SYS address to start 32 Sprites, your program must clear out the shadow registers; otherwise, a screen full of garbage sprites will appear on the screen when 32 Sprites starts. You can do this by poking 0s into the shadow registers with something like the following.

```
100 FOR J=0 TO 31: POKE 52992+J,0: NEXT
```

This line will set each sprite's Y position to 0. Don't forget to do this to any other shadow registers which are being used, too.

Once all registers have been cleared and/or set up as desired, use SYS and the starting address of the machine language program. Thirty-two

Sprites will enable raster interrupts, clear out the temp page, and begin to operate.

The best way to handle the shadow registers is to define a variable at the beginning of the program with the registers' location. Here's an example.

110 YPOS=52992: REM Y POSITION SHADOWS

Then to change any given sprite's Y position, use the POKE command.

120 POKE YPOS+5,100: REM SPRITE 6'S YPOS

Note that you subtract 1 from the sprite's actual number. To change sprite 32's Y position, you'd add 31 to the YPOS. To change sprite 1's Y position, you could use YPOS plus 0, or simply YPOS.

The shadow registers of High X bit, X expand, Multicolor, and Priority operate a bit differently. Each of these registers can be either off (by poking them with a 0) or on (by poking them with any number other than 0).

Each of the sprite parameters you turned on before generating 32 Sprites with its BASIC generator can be changed for each sprite by using the corresponding shadow register. Note that 32 Sprites doesn't change any registers in the VIC chip which you turned off before generating 32 Sprites.

For example, multicolor can still be used even if you didn't turn it on from 32 Sprite's main menu. However, because you told 32 Sprites to leave the register off, its shadow registers won't work, and you won't be able to tell 32 Sprites which sprites are multicolor and which are not. But you can change the actual register in the VIC chip.

For example, if you decide beforehand that you are going to design all of your sprites in multicolor mode, you could turn off the multicolor shadow registers before generating and then tell the VIC chip to display all sprites that it draws in multicolor by using POKE 53276,255.

32 Sprites won't interfere with the multicolor register, and the VIC will display all eight sprites as multicolor. In order to display more sprites, 32 Sprites

tricks the VIC into displaying either two, three, or four sets of eight sprites on the same screen. The VIC believes it's displaying eight sprites in all, and it displays them in multicolor.

Thirty-two Sprites can handle up to the maximum number of sprites you set for it on the main menu. Every single sprite can be displayed anywhere on the screen. Displaying more than eight sprites on a horizontal row could cause flickering and some distortion. Thirty-two Sprites operates at its best when the sprites are spaced out along the y-axis. Careful designing of game screens will prevent too many sprites on one row.

You may have noticed there wasn't a shadow register which turns a sprite on or off. To do this with 32 Sprites, simply set the corresponding sprite's Y position to 0. This tells 32 Sprites you don't wish to have that sprite drawn.

Hints and Tips

While greatly enhancing the 64's graphics capabilities, 32 Sprites is a machine language routine which does take up processor time. The more sprites displayed on the screen and the more parameters set to on, the slower the computer runs. The best way to conserve speed is to cut down on the number of sprites. Of course, whenever you need all 32 sprites, this will not be possible.

The other way to increase the speed of the computer is to turn off any unneeded sprite parameters. In 32 Sprites' machine language routine, only the parameters turned on are updated by the program. The rest are left to the VIC chip to handle. Although it takes a minimal amount of time to copy a value from a shadow register to the corresponding VIC register, it becomes noticeable when you multiply this time by 32.

The parameters which bog down the computer the most are the High X bit, X expand, Multicolor, and Priority. Do without them whenever you can. Although the High X bit cannot usually be done without, Priority is rarely used and can usually be set to off.

The next way to conserve processor time is to place the sprites nearer the top of the screen. Thirty-two Sprites begins at the top of the screen and search-

es down until it finds the number of sprites for which it was set. By placing the sprites closer to the top, 32 Sprites will have to do less searching and use less processor time.

You may notice some distortion of the tops and bottoms of the sprites when you're using 32 of them. This is because the computer may be too slow to update the VIC registers as fast as needed when the sprites are in certain positions. The best way to avoid this is to leave the top and bottom row or two of the sprite definitions blank.

Because 32 Sprites is a raster interrupt, it does change the interrupt vector at \$0314-\$0315. Machine language programmers can still use another interrupt, as long as it doesn't use another raster interrupt. Every 1/60 second, like the normal timer interrupt, and after all the sprites on the screen have been drawn, 32 Sprites jumps to the normal interrupt routine, usually located at \$EA31. This JMP is located at the starting address plus \$61. It can easily be changed to jump to your own interrupt routine instead. Just remember to end your interrupt with JMP \$EA31.

Although 32 Sprites provides improved sprite capability and flexibility, it's not infallible. Placing the sprites in certain positions can often cause flicker or cause some sprites to disappear. The best way to prevent flicker is to design playing screens which space the sprites out along the y-axis.

Since the VIC chip is actually limited to eight sprites, 32 Sprites divides all of the sprites into eight-sprite chunks and displays each chunk as one group. You still cannot display more than eight sprites on a horizontal line because of the VIC chip's limitations. If you decide to put more than eight on one row, 32 Sprites will do its best to display more than eight sprites per horizontal line.

How It Works

Thirty-two Sprites works by use of the VIC chip feature called raster interrupts. The computer screen is redrawn every 1/60 second. After one screen is drawn but before the next one begins, 32 Sprites quickly sorts the sprites in order from lowest Y position to highest Y position. On the screen, that is from

the sprite closest to the top to the one closest to the bottom.

The program then displays the top-most eight sprites and tells the VIC chip to let 32 Sprites know when these sprites have been drawn. Once the VIC chip alerts 32 Sprites, the screen is only partially redrawn. The top-most eight sprites have been drawn, but the rest of the screen hasn't been drawn yet. So 32 Sprites puts the next eight sprites into the VIC's registers, and they are drawn. This process repeats for each series of eight sprites.

A Demonstration

To give you some idea of 32 Sprites's power, try this demonstration program. The demo consists of a BASIC program and machine language sprite data. Before you can run the demo, however, you must generate 32 Sprites. Load and run the main BASIC program. Once the menu comes up, type 14 and hit Return. When the program asks you if you want to save to disk, answer Y and type in 32 for the filename. This is the name the demo searches for when it runs. Don't print out the information sheet at this time.

To help avoid typing errors, enter the demo with The Automatic Proofreader. Save the program before you try to run it.

Sprite data is written in machine language. Enter it with MLX, our machine language entry program. Again, see "Typing Aids." When MLX prompts, respond with the following addresses.

Starting address: C3A0

Ending address: CAFF

Since the demo automatically loads this data, save it with the filename 32 DEMO.ML. Make sure that this file and 32 are all on the same disk as the demo. Control the demonstration with a joystick plugged into port 2.

32 Sprites

KX 100 REM COPYRIGHT 1993 - COMPUTE PUBLICATIONS - ALL RIGHTS RESERVED
HB 110 REM WRITTEN BY BILL SOUDAN
MA 120 REM
KC 130 POKE53281,0:POKE53280,0
XX 140 PRINT "{CLR}":ZP=191
XX 140 PRINT "{CYN}{CLR}{H}{N}

```
{BLU}{G}{CYN}
{14 SPACES}32 SPRITES"
MP 150 POKE1063,103:POKE55335,6
DK 160 PRINT "{BLU}{39 T}{LEFT}{INST}{T}"
FP 170 PRINT:PRINTTAB(15)"{3}MAIN MENU"
RG 180 PRINT:DIM P$(12),P(12,1),H$(16)
CE 190 X$="0123456789ABCDEF"
RJ 200 FORJ=1TO16:H$(J-1)=MID$(X$,J,1):NEXT
RQ 210 FORJ=0TO12:READP$(J):NEXT
EG 220 DATA "STARTING ADDRESS","Y POSITION","X POSITION","HIGH X BIT"
EP 230 DATA "X EXPAND","COLOR","MULTICOLOR","PRIORITY","POINTER"
DX 240 DATA "TEMP PAGE","ORDER TABLE","EXTRA Y TABLE","MAX # OF MOBS"
PM 250 FORJ=0TO12:READ P(J,0),P(J,1):NEXT
FK 260 DATA 3,49152,3,52992,1,53024
HE 270 DATA 1,53056,2,53088,1,53120
QC 280 DATA 2,53152,2,53184,1,53216
GB 290 DATA 3,52736,3,52672,3,52704
EM 300 DATA 3,32
JM 310 FORP=0TO12:GOSUB1200:NEXT
RC 320 PRINT "{YEL}14) {CYN}GENERATE {WHT}32 SPRITES"
HR 330 W$="{HOME}{2 DOWN}"
EB 340 GOSUB1360:PRINTW$;:INPUT T"{3}YOUR CHOICE";CS
AA 350 C=VAL(C$):IFC<10RC>14TH EN340
JG 360 IFC>12THEN470
RA 370 IFC<1,0)=3THEN420
AF 380 GOSUB1360:PRINTW$;:PRINT "{3}SELECT: ";P$(C-1);" {WHT}1. {3} ON {2 SPACES}{3}2. {WHT} {2 SPACES}OFF"
GD 390 GETA$:IFA$<>"1"ANDAS$<>"2"THEN390
AR 400 IFA$="1"THENP(C-1,0)=1
BJ 410 IFA$="2"THENP(C-1,0)=2
CR 420 GOSUB1360:PRINTW$;:ML$="-1":INPUT "{3}NEW MEMORY LOCATION";ML$
JF 430 IFLEFT$(ML$,1)="$"ANDLEN(ML$)=5THEND$=ML$:GOSUB1340:ML=D:GOTO450
JA 440 ML=VAL(ML$):IFML<0ORML>65535THEN460
MG 450 P(C-1,1)=ML
SS 460 P=C-1:GOSUB1200:GOTO340
JF 470 IFC=14THEN510
```

```
CJ 480 GOSUB1360:PRINTW$;:PRINT "{3}SELECT: {WHT}1. {3} 16 {WHT}2. {3} 24 {WHT} 3. {3} 32"
EP 490 GETA$:IFA$<>"1"ANDAS$<>"2"ANDAS$<>"3"THEN490
AG 500 P(12,1)=(VAL(AS$)*8)+8:GOTO460
AF 510 REM GENERATE ML CODE
HQ 520 AD=P(0,1)
KK 530 GOSUB1370
DM 540 PRINT "{HOME}{11 DOWN}"
G "{CYN}"TAB(12)"GENERATING ML..."
KB 550 DEF FNH(X)=INT(X/256)
KR 560 DEF FNL(X)=X-(FNH(X)*256)
MM 570 PRINT "{DOWN}"TAB(9)"INITIALIZATION CODE..."
GF 580 MP=0:GOSUB1440
KG 590 FORJ=1TOP(12,1)/8:PRINTTAB(12)"RASTER HANDLER";J:GOSUB1560:NEXT
BB 600 AD=AD-34:DA$="A9FA8D12D0A9008D00004C31EA":GOSUB1430
XK 605 POKEAD-5,FNL(P(0,1)+100):POKEAD-4,FNL(P(0,1)+100)
JD 607 GOSUB 1907
HK 608 DI=AD:DA$="78A9318D1403A9EA8D1503A9008D15D08D1AD0A9818D0DDCA9008D0DDCA993"
HJ 609 DA$=DA$+"20D2FF5860":GOSUB1430
HP 610 GOSUB1370:PRINT "{HOME}{7 DOWN}"TAB(16)"COMPLETE."
AS 620 PRINTTAB(5)"{2 DOWN}BEGINNING ADDRESS: ";D=P(0,1):GOSUB1300
PF 630 PRINTP(0,1);" $"+AS:PRINTTAB(5)"ENDING ADDRESS: {3 SPACES}";D=AD:GOSUB1300
JA 632 PRINTAD;" $"+AS
QJ 635 PRINT "{DOWN} ENABLE 32 {SPACE}SPRITES: {3 SPACES}";D=P(0,1):GOSUB1300
JP 636 PRINT "SYS";P(0,1);" (JMP {SHIFT-SPACE}$"+AS+)"
QM 637 PRINT "DISABLE 32 SPRITES: {2 SPACES}";D=DI:GOSUB1300
FX 638 PRINT "SYS";DI;" (JMP {SHIFT-SPACE}$"+AS+)"
AM 640 PRINTTAB(13)"{2 DOWN}SAVE 32 SPRITES ML?"
KP 650 GETA$:IFA$<>"Y"ANDAS$<>"N"THEN650
RE 660 IFA$="N"THEN710
KS 670 GOSUB1370:PRINT "{HOME}{7 DOWN}"TAB(5)"ENTER FILENAME: ";OPENL,0:INPUT T#1,F$;CLOSE1
```


PROGRAMS

```

JD 680 PRINT:PRINTTAB(15)"
      {2 DOWN}SAVING...."
DQ 690 SYS57812 FS,8,1:POKE193
      FNL(P(0,1)):POKE194,FN
      H(P(0,1)):POKE174,FNL(A
      D+1)
XM 700 POKE175,FNH(AD+1):SYS 6
      2957
KG 710 GOSUB1370:PRINT"(HOME)
      {10 DOWN}"TAB(10)"PRINT
      OUT INFO SHEET?"
RP 720 GETAS:IFAS<>"Y"ANDAS<>"
      N"THEN720
SC 730 IFAS="N"THENPRINT"{CLR}
      ":END
KM 740 GOSUB1370:PRINT"(HOME)
      {10 DOWN}"TAB(14)"PRINT
      ING...."
MR 750 OPEN4,4,7:PRINT#4:PRINT
      #4:PRINT#4
KE 760 PRINT#4,SPC(23)"32 SPRI
      TES"
QH 770 PRINT#4:PRINT#4:PRINT#4
DG 780 PRINT#4,SPC(23)"STARTIN
      G ADDRESS:";D=P(0,1):G
      OSUB1300
GE 790 PRINT#4,P(0,1);" $"+AS:
      PRINT#4,SPC(23)"ENDING
      {SPACE}ADDRESS:
      {2 SPACES}";D=AD:GOSUB
      1300
CK 800 PRINT#4,AD;" $"+AS:PRIN
      T#4
QX 802 PRINT#4,SPC(19)"ENABLE
      {SPACE}32 SPRITES:
      {3 SPACES}";D=P(0,1):G
      OSUB1300
SA 804 PRINT#4,"SYS";P(0,1);"
      {SPACE}(JMP
      {SHIFT-SPACE}$"+AS+)"
HC 806 PRINT#4,SPC(19)"DISABLE
      32 SPRITES:{2 SPACES}"
      ;D=DI:GOSUB1300
ES 808 PRINT#4,"SYS";DI;" (JMP
      {SHIFT-SPACE}$"+AS+)"":
      PRINT#4:PRINT#4
BR 810 FORJ=1TO12:PRINT#4,SPC(
      16);P$(J);SPC(20-LEN(P$
      (J)));
AF 820 IFP(J,0)=3THENPRINT#4,"
      N/A";
MX 830 IFP(J,0)=2THENPRINT#4,"
      OFF";
GJ 840 IFP(J,0)=1THENPRINT#4,"
      ON ";
RR 850 PRINT#4,SPC(5);P(J,1);:
      D=P(J,1):GOSUB1300
RX 860 PRINT#4,SPC(10-LEN(STR$
      (P(J,1))));"$"+AS:NEXT
      BQ 870 PRINT#4:CLOSE4:END
PJ 880 DATA 78,A9,<0+72,8D,14,
      03,A9,>0+72
FS 890 DATA 8D,15,03,A9,7F,8D,
      0D,DC,A9,01
EJ 900 DATA 8D,1A,D0,AD,11,D0,
      29,7F,8D,11
JB 910 DATA D0,A9,FA,8D,12,D0,
      A9,00,8D
SF 920 DATA <0+100,>0+100,A9,F
      F,A2,00,9D
FH 930 DATA <9,>9,E8,D0,FA,A9,
      FF,8D,15,D0
RR 940 DATA 58,60,01,02,04,08,
      10,20,40,80
DR 950 DATA FE,FD,FB,F7,EF,DF,
      BF,7F,A9,01
HK 960 DATA 8D,19,D0,AD,<0+100
      ,>0+100,0A
XB 970 DATA A8,B9,<0+101,>0+10
      1,8D,<0+95
SC 980 DATA >0+95,B9,<0+102,>0
      +102,8D
RQ 990 DATA <0+96,>0+96,4C,FF,
      FF,4C,31,EA
KM 1000 DATA 00,<0+111,>0+111,
      00,00,00,00
DH 1010 DATA 00,01,00,00,A2,00
      ,BD,<1,>1,C9,1D,90,0E,
      A8
GB 1020 DATA B9,<9,>9,30,04,C8
      ,4C,<0+121
DS 1030 DATA >0+121,8A,99,<9,>
      9,E8,E0,<C
MD 1040 DATA 90,E6,A2,00,A0,1D
      ,B9,<9,>9,10
BA 1050 DATA 4F,C8,B9,<9,>9,10
      ,49,C8,B9,<9
DK 1060 DATA >9,10,43,C8,B9,<9
      ,>9,10,3D,C8
XB 1070 DATA B9,<9,>9,10,37,C8
      ,B9,<9,>9,10
DD 1080 DATA 31,C8,B9,<9,>9,10
      ,2B,C8,B9,<9
SM 1090 DATA >9,10,25,C8,B9,<9
      ,>9,10,1F,C8
AA 1100 DATA B9,<9,>9,10,19,C8
      ,B9,<9,>9,10
AC 1110 DATA 13,C8,B9,<9,>9,10
      ,0D,C8,B9,<9
GH 1120 DATA >9,10,07,C8,C0,1D
      ,B0,AE,90,0F
CC 1130 DATA 9D,<A,>A,A9,FF,99
      ,<9,>9,E8,E0
RB 1140 DATA <C,90,A4,B0,18
RS 1142 DATA E0,08,B0,05,BC,<0
      +56,>0+56
EE 1144 DATA 88,2C,A0,FF,8C,15
      ,D0
CD 1149 DATA A9,FF,9D,<A,>A
BH 1150 DATA E8,E0,<C,90,F8,EE
      ,<0+100
BM 1160 DATA >0+100,A2,<C,CA
BX 1170 DATA BD,<1,>1,9D,<B,>B
      ,CA,10,F7,XX
PM 1180 END
DE 1200 POKE214,5+P:PRINT
BQ 1210 PRINT"{YEL}";P+1;"
      {LEFT} {CYN}"P$(P)
      PRINT"{UP}"TAB(22);
FF 1220 IFP(P,0)=1THENPRINT"
      {3}ON "
QJ 1230 IFP(P,0)=2THENPRINT"
      {4}OFF"
HA 1240 IFP(P,0)=3THENPRINT"
      {4}ON "
MC 1250 IFP(P,0)=3THENPRINT"
      {RED}N/A{3}"
BJ 1260 PRINT"{UP}"TAB(26);P(P
      ,1);"{5 SPACES}"
SA 1270 D=P(P,1):GOSUB1300
AX 1280 PRINT"{UP}"TAB(34)"$";
      AS
BD 1290 RETURN
KF 1300 T=INT(D/4096):AS=H$(T)
      :D=INT(D-T*4096)
JA 1310 T=INT(D/256):AS=AS+H$(
      T):D=INT(D-T*256)
KA 1320 T=INT(D/16):B$=AS:AS=A
      $+H$(T):D=INT(D-T*16):
      B$=H$(T)+H$(D)+B$
JE 1330 AS=AS+H$(D):RETURN
QP 1340 D=0:FORJ=3TO0STEP-1:J1
      =ASC(MID$(D$,5-J,1))-4
      8:IFJ1>16THENJ1=J1-7
DA 1350 D=D+(J1*16↑J):NEXT:RET
      URN
JK 1360 FORX=21TO24:POKE781,X:
      SYS 59903:NEXT:RETURN
KB 1370 FORX=20TO24:POKE781,X:S
      YS59903:NEXT:RETURN
FB 1380 DA$="68F00D":GOSUB1430
QE 1390 POKEAD,185:POKEAD+1,FN
      L(P(0,1)+56-SB):POKEAD
      +2,FNH(P(0,1)+56-SB):A
      D=AD+3
EG 1400 DA$="0D"+AA$+"8D"+AA$+
      "F00BD009":GOSUB1430
FX 1410 POKEAD,185:POKEAD+1,FN
      L(P(0,1)+64-SB):POKEAD
      +2,FNH(P(0,1)+64-SB):A
      D=AD+3
CQ 1420 DA$="2D"+AA$+"8D"+AA$:
      GOSUB1430:RETURN
CJ 1430 MP=1:FORJJ=1TOLEN(DA$)
      STEP2:AS=MID$(DA$,JJ,2
      ):GOSUB1450:NEXT:MP=0:
      RETURN
XM 1440 READAS:IFAS="XX"THENRE
      TURN
KG 1450 IFLEFT$(AS,1)="<"THEN1
      500
AX 1460 IFLEFT$(AS,1)=">"THEN1
      530
GS 1470 A1=ASC(LEFT$(AS,1))-48
      :A2=ASC(RIGHT$(AS,1))-
      48:IFA1>16THENA1=A1-7
QB 1480 IFA2>16THENA2=A2-7
SE 1490 POKEAD,A1*16+A2:AD=AD+
      1:ON -(MP=0) GOTO1440
      {SPACE}:RETURN
HK 1500 PL=0:IFLEN(AS)>2THENPL
      =VAL(MID$(AS,4))
RA 1510 WG$=MID$(AS,2,1):WG=VA
      L(WG$):IFWG$>"@ANDWG$
      <"D"THENWG=ASC(WG$)-55
HS 1520 POKEAD,FN L(P(WG,1)+PL
      ):AD=AD+1:ON -(MP=0) G
      OTO1440:RETURN
SP 1530 PL=0:IFLEN(AS)>2THENPL
      =VAL(MID$(AS,4))
ER 1540 WG$=MID$(AS,2,1):WG=VA
      L(WG$):IFWG$>"@ANDWG$
      <"D"THENWG=ASC(WG$)-55

```



```

ER 1550 POKEAD,FN H(P(WG,1)+PL
):AD=AD+1:ON -(MP=0) G
OTO1440 :RETURN
BH 1560 POKEP(0,1)+101+J*2,FNL
(AD):POKEP(0,1)+102+J*
2,FNH(AD)
GF 1570 DA$="A200A0":IFJ=1THEN
DA$=DA$+"00":EP$="08":
SB=0
HF 1580 IF J=2THENDA$=DA$+"08"
:EP$="10":SB=8
DA 1590 IFJ=3THENDA$=DA$+"10":
EP$="18":SB=16
QR 1600 IFJ=4THENDA$=DA$+"18":
EP$="20":SB=24
BB 1610 DA$=DA$+"84BF":GOSUB14
30
AG 1620 IFJ=1THENB1=AD:GOTO166
0
QS 1630 B1=AD:DA$="B9":GOSUB14
30
AF 1640 POKEAD,FNL(P(10,1)-8):
POKEAD+1,FNH(P(10,1)-8
):AD=AD+2
AH 1650 DA$="300EA8B9<B>BA4BF1
86914CD12D0B0FB":GOSUB
1430
CJ 1660 DA$="B9<A>A":GOSUB1430
GP 1670 DA$="10034C0000A8":GOS
UB1430
SP 1680 DA$="B9<B>B9D01D0":GOS
UB1430
HK 1690 IFP(2,0)=1THENDA$="B9<
2>29D00D0":GOSUB1430
ES 1700 IFP(7,0)=1THENDA$="B9<
7>748":GOSUB1430
BF 1710 IFP(4,0)=1THENDA$="B9<
4>448":GOSUB1430
RQ 1720 IFP(6,0)=1THENDA$="B9<
6>648":GOSUB1430
GD 1730 IFP(5,0)=1THENDA$="B9<
5>548":GOSUB1430
PP 1740 IFP(3,0)=1THENDA$="B9<
3>348":GOSUB1430
XX 1750 IFP(8,0)=1THENDA$="B9<
8>8A4BF99":GOSUB1430
BB 1760 IFP(8,0)=1THENPOKEAD,F
NL(2040-SB):POKEAD+1,F
NH(2040-SB):AD=AD+2
HE 1770 IFP(3,0)=1THENAA$="10D
0":GOSUB1380
QH 1780 IFP(5,0)=1THENDA$="689
9":GOSUB1430
PE 1790 IFP(5,0)=1THENPOKEAD,F
NL(53287-SB):POKEAD+1,
FNH(53287-SB):AD=AD+2
EE 1800 IFP(6,0)=1THENAA$="1CD
0":GOSUB1380
XP 1810 IFP(4,0)=1THENAA$="1DD
0":GOSUB1380
FP 1820 IFP(7,0)=1THENAA$="1BD
0":GOSUB1380
QD 1830 PL=6:IFJ>1THENPL=25
AF 1840 POKEB1+PL,FNL(AD):POKE
B1+PL+1,FNH(AD):DA$="E
8E8C884BFC0"+EP$:GOSUB
1430
PQ 1850 D=254-(AD-B1)
QG 1860 IFD>129THENGOSUB1300:D
A$="D0"+RIGHT$(A$,2):G
OSUB1430:GOTO1880
BS 1870 DA$="F0034C":D=B1:GOSU
B1300:DA$=DA$+B$:GOSUB
1430
QS 1880 DA$="AD<A>A3010A8B9<B>
B38E9078D12D0EE00004CB
CFA9008D0000A9FA8D12D
04C31EA"
QS 1885 GOSUB1430
MK 1890 POKEAD-33,FNL(P(10,1)+
8+SB):POKEAD-32,FNH(P(
10,1)+8+SB)
XA 1900 POKEAD-10,FNL(P(0,1)+1
00):POKEAD-9,FNH(P(0,1
)+100)
XG 1905 POKEAD-18,FNL(P(0,1)+1
00):POKEAD-17,FNH(P(0,
1)+100)
SQ 1907 POKEAD-2,FNL(P(0,1)+97
):POKEAD-1,FNH(P(0,1)+
97)
BK 1910 RETURN
FG 1920 B1=AD:DA$="B90000300EA
8B9<1>1A4BF186914CD12D
0B0FB":GOSUB1430
BE 1930 POKEB1+1,FNL(P(10,1)-8
):POKEB1+2,FNH(P(10,1)
-8):RETURN

```

32 DEMO

```

XR 100 REM 32 SPRITES DEMO
GA 110 REM
FP 120 PRINT "{CLR}{N}{H}":POKE
53281,0:POKE53280,0
EH 125 IFA=0THEN A=1:LOAD"32 D
EMO.ML",8,1
BE 127 IFA=1THEN A=2:LOAD"32",
8,1
JX 130 REM INITIALIZE 32 SPRIT
E REGISTERS
HH 135 DIM C(10)
EQ 140 Y=52992:X=53024:HX=5305
6:C=53120
KE 150 P=53216:PR=53275
AF 160 FORJ=0TO31:POKEY+J,0:PO
KEX+J,0:POKEHX+J,0:POKE
C+J,0:POKEPJ+J,14:NEXT
CS 170 FORJ=0TO63:POKE704+J,0:
POKE832+J,0:POKE896+J,0
:NEXT
QF 180 FORJ=3TO59:POKE832+J,25
5:NEXT
KD 190 POKEPR,255:SYS 50080:SY
S 49152:POKE53269,255
PJ 200 DT$="{HOME}{24 DOWN}"
SS 210 PRINTLEFT$(DT$,8);TAB(1
5){CYN}32 SPRITES"
JJ 220 PRINTTAB(9){7}CUSTOM 3
2-SPRITE RASTER"
EB 230 PRINTTAB(15)"CONTROLLER
"
RB 240 PRINT:PRINTTAB(9)"YOU C
AN DISPLAY UP TO 32"
JD 250 PRINTTAB(6)"SPRITES ON

```

```

{SPACE}THE SCREEN AT AN
Y"
QS 260 PRINTTAB(7)"TIME. EACH
{SPACE}SPRITE CAN MOVE"
CQ 270 PRINTTAB(9)"ANYWHERE ON
THE SCREEN."
RK 280 FORCL=1TO10:READC(CL):N
EXT:DATA 8,2,9,10,7,1,7
,10,9,2
AX 290 FORJ=31TO0STEP-1:POKEP+
J,13:FORCL=1TO10:POKEC+
J,C(CL):NEXT:NEXT
QC 300 GOSUB 1010
DF 310 GOSUB 1000
XM 320 PRINTLEFT$(DT$,12);TAB(
7)"YOU HAVE FULL CONTRO
L OVER"
PB 330 PRINTTAB(7)"EVERY SPRIT
E OPTION EXCEPT"
AS 340 PRINTTAB(13)"Y-EXPANSIO
N."
RQ 350 FORJ=0TO31:POKEC+J,INT(
RND(1)*15)+1:NEXT:GOSUB
1020
RD 360 FORJ=0TO31:POKEC+J,2:NE
XT:GOSUB1020
FG 370 FORJ=0TO63:POKE832+J,0:
NEXT
RR 375 FORJ=0TO31:A=INT(RND(1)
*3)+1:IFA=1THENPP=13
EQ 377 IFA=2THENPP=14
RS 378 IFA=3THENPP=11
JM 379 POKEP+J,PP:NEXT:CC=85
DA 380 FORJ=3TO59:POKE704+J,IN
T(RND(1)*256):POKE896+J
,CC:CC=255-CC:POKE832+J
,255
KP 385 NEXT
SK 390 POKE53285,7:POKE53286,1
0
FK 400 GOSUB1020:POKE53276,255
:GOSUB1020:GOSUB1020:PO
KE53276,0:GOSUB1020
BA 410 FORJ=0TO31:POKEP+J,13:N
EXT
ER 420 GOSUB1020:POKE53277,255
:GOSUB1020:POKE53277,0
FS 440 PRINTLEFT$(DT$,12);TAB(
5)"MOVE SPRITE #1
{2 SPACES}WITH JOYSTICK
"
JM 450 PRINTTAB(2)"IN PORT 2.
{2 SPACES}PRESS + AND -
TO CHANGE"
EF 460 PRINTTAB(3)"SPRITE NUMB
ER.{2 SPACES}PRESS C TO
CHANGE"
FJ 470 PRINTTAB(8)"COLOR. PRES
S Q TO QUIT."
BF 480 SYS 50272:POKE254,0:SP=
1
GE 490 POKE254,SP-1:PRINTLEFT$(
DT$,12);TAB(18);MID$(S
TR$(SP),2);" "
DG 500 GETA$:IFA$="+ANDSP<32T
HENSPP=SP+1:GOTO 490
EH 510 IFA$="-ANDSP>1THENSPP=S

```


PROGRAMS

```

P-1:GOTO 490
EJ 520 IFA$="C"THENPOKEC+SP-1,
      (PEEK(C+SP-1)+1)AND15
EG 530 IFA$<>"Q"THEN500
GS 540 POKE828,0:SYS 828
GG 999 END
DH 1000 FORJ=1TO24:POKE781,J:
      SYS 59903:NEXT:RETURN
DJ 1010 FORJ=1TO1000:NEXT:RETU
      RN
PQ 1020 FORJ=1TO500:NEXT:RETUR
      N

```

32 DEMO.ML

```

C3A0:78 A9 00 8D 62 C0 A9 C4 D5
C3A8:8D 63 C0 A2 00 8A 0A 0A 5A
C3B0:0A 0A 9D E0 C4 8A 4A 4A B0
C3B8:4A 4A 9D C0 C4 E8 E0 20 63
C3C0:90 EB 58 60 39 00 39 00 D8
C3C8:39 00 39 00 39 00 39 00 50
C3D0:39 00 39 00 39 00 39 00 58
C3D8:39 00 39 00 39 00 39 00 60
C3E0:39 00 39 00 39 00 39 00 68
C3E8:39 00 39 00 39 00 39 00 70
C3F0:39 00 39 00 39 00 39 00 78
C3F8:39 00 39 00 39 00 39 00 80
C400:A2 00 BD C0 C4 D0 24 BC 0D
C408:E0 C4 B9 00 C5 9D 20 CF 1F
C410:B9 00 C7 9D 40 CF B9 00 FD
C418:C9 9D 00 CF C8 D0 05 A9 28
C420:01 9D C0 C4 98 9D E0 C4 B7
C428:4C 50 C4 BC E0 C4 B9 00 DD
C430:C6 9D 20 CF B9 00 C8 9D 82
C438:40 CF B9 00 CA 9D 00 CF A9
C440:C8 C0 FE 90 07 A9 00 9D C3
C448:C0 C4 A0 00 98 9D E0 C4 39
C450:E8 E0 20 90 AD 4C 31 EA 7F
C458:00 00 00 00 00 00 00 00 E1
C460:78 A9 75 8D 62 C0 A9 C4 46
C468:8D 63 C0 A9 00 85 FD 85 DB
C470:FC 85 FE 58 60 A6 FE AD 88
C478:00 DC 4A 90 03 FE 00 CF 6F
C480:4A 90 03 DE 00 CF 4A 90 06
C488:15 48 BD 20 CF 18 69 01 1B
C490:9D 20 CF 90 08 BD 40 CF 7B
C498:49 01 9D 40 CF 68 4A 90 04
C4A0:15 48 BD 20 CF 38 E9 01 B4
C4A8:9D 20 CF B0 08 BD 40 CF 95
C4B0:49 01 9D 40 CF 68 4C 31 C0
C4B8:EA 00 00 00 00 00 00 00 B7
C4C0:01 01 01 01 01 01 01 01 4A
C4C8:01 01 01 01 01 00 00 00 5A
C4D0:00 00 00 00 00 00 00 00 4B
C4D8:00 00 00 00 00 01 01 01 69
C4E0:3A 4A 5A 6A 7A 8A 9A AA E9
C4E8:BA CA DA EA FA 0A 1C 2C F8
C4F0:3C 4C 5C 6C 7C 8C 9C AC F9
C4F8:BC CC DC EC FC 0C 1C 2C FA
C500:A9 97 90 8B 86 83 7C 79 C5
C508:76 74 71 6F 6A 69 67 65 3E
C510:62 60 5D 5B 5A 58 56 56 81
C518:53 51 50 50 4E 4C 4B 49 34
C520:47 47 46 44 42 41 41 3F 07
C528:3F 3E 3C 3C 3A 3A 39 39 94
C530:37 35 35 34 34 32 30 30 89
C538:30 2F 2F 2D 2D 2B 2B 2B F7
C540:2A 2A 28 28 28 26 26 26 3F
C548:25 25 25 23 23 23 21 21 8F
C550:21 21 20 20 20 1E 1E 1E 8E
C558:1E 1E 1C 1C 1C 1C 1C 1B 64

```

```

C560:1B 1B 1B 1B 1B 19 19 19 DD
C568:19 19 19 18 18 18 18 E4
C570:18 18 18 18 18 18 18 FB
C578:18 18 18 18 18 18 16 02
C580:18 18 18 18 18 18 18 0C
C588:18 18 18 18 18 18 18 14
C590:13 18 18 19 19 19 19 3B
C598:19 19 19 1B 1B 1B 1B 62
C5A0:1B 1C 1C 1C 1C 1C 1E 1E B1
C5A8:1E 1E 20 20 20 20 21 21 B5
C5B0:21 23 23 23 25 25 25 59
C5B8:26 26 28 28 28 2A 2A D0
C5C0:2B 2B 2D 2D 2D 2F 30 30 DB
C5C8:30 32 32 34 35 35 37 37 A6
C5D0:39 39 3A 3C 3C 3E 3E 3F E8
C5D8:41 41 42 44 44 46 47 49 F4
C5E0:4B 4B 4C 4E 50 51 53 55 17
C5E8:56 58 5A 5B 5D 5F 60 62 42
C5F0:67 69 6A 6C 6F 71 76 79 46
C5F8:7C 80 83 86 90 97 A9 A9 9B
C600:A9 BA C0 CA CD D1 DA D7 0D
C608:DB E0 E1 E5 E6 E8 EA EE F5
C610:F0 F2 F3 F5 F7 F8 FA FC 47
C618:FD FF 01 02 04 06 06 07 30
C620:09 0B 0C 0C 0E 10 11 19
C628:13 13 15 15 16 18 18 19 52
C630:19 1B 1B 1D 1E 1E 20 20 10
C638:20 22 23 23 23 25 25 27 14
C640:27 27 28 28 28 2A 2A 2C 1D
C648:2C 2C 2C 2D 2D 2D 2F 2F FA
C650:2F 31 31 31 31 32 32 32 E3
C658:32 34 34 34 34 34 36 36 EA
C660:36 36 36 36 37 37 37 37 FC
C668:37 37 37 37 39 39 39 39 14
C670:39 39 39 39 39 39 39 39 FD
C678:39 39 39 39 39 39 39 39 08
C680:39 39 39 39 39 39 39 39 0E
C688:39 39 39 39 39 39 39 39 16
C690:39 39 39 37 37 37 37 37 DF
C698:37 37 36 36 36 36 36 36 E6
C6A0:34 34 34 34 34 32 32 32 20
C6A8:32 32 31 31 31 2F 2F 2F E8
C6B0:2F 2D 2D 2D 2C 2C 2C 2A 2E
C6B8:2A 2A 28 28 27 27 25 BE
C6C0:25 25 23 23 22 22 20 BA
C6C8:20 1E 1D 1D 1B 1B 19 18 F2
C6D0:18 16 16 15 15 13 11 11 2C
C6D8:10 10 0E 0C 0B 09 07 0A 8C
C6E0:06 04 02 01 01 FF FD FA C1
C6E8:F8 F8 F7 F5 F3 F0 EE EB BC
C6F0:EA E8 E6 E1 E0 DC DB D7 33
C6F8:D4 CD CA C5 C0 BA A9 23 81
C700:00 00 00 00 00 00 00 00 8F
C708:00 00 00 00 00 00 00 00 97
C710:00 00 00 00 00 00 00 00 9F
C718:00 00 00 00 00 00 00 00 A7
C720:00 00 00 00 00 00 00 00 AF
C728:00 00 00 00 00 00 00 00 B7
C730:00 00 00 00 00 00 00 00 BF
C738:00 00 00 00 00 00 00 00 C7
C740:00 00 00 00 00 00 00 00 CF
C748:00 00 00 00 00 00 00 00 D7
C750:00 00 00 00 00 00 00 00 DF
C758:00 00 00 00 00 00 00 00 E7
C760:00 00 00 00 00 00 00 00 EF
C768:00 00 00 00 00 00 00 00 F7
C770:00 00 00 00 00 00 00 00 FF
C778:00 00 00 00 00 00 00 00 08
C780:00 00 00 00 00 00 00 00 10
C788:00 00 00 00 00 00 00 00 18

```

```

C790:00 00 00 00 00 00 00 00 20
C798:00 00 00 00 00 00 00 00 28
C7A0:00 00 00 00 00 00 00 00 30
C7A8:00 00 00 00 00 00 00 00 38
C7B0:00 00 00 00 00 00 00 00 40
C7B8:00 00 00 00 00 00 00 00 48
C7C0:00 00 00 00 00 00 00 00 50
C7C8:00 00 00 00 00 00 00 00 58
C7D0:00 00 00 00 00 00 00 00 60
C7D8:00 00 00 00 00 00 00 00 68
C7E0:00 00 00 00 00 00 00 00 70
C7E8:00 00 00 00 00 00 00 00 78
C7F0:00 00 00 00 00 00 00 00 80
C7F8:00 00 00 00 00 00 00 00 88
C800:00 00 00 00 00 00 00 00 91
C808:00 00 00 00 00 00 00 00 99
C810:00 00 00 00 00 00 00 00 A1
C818:00 00 01 01 01 01 01 01 E8
C820:01 01 01 01 01 01 01 01 B1
C828:01 01 01 01 01 01 01 01 B9
C830:01 01 01 01 01 01 01 01 C1
C838:01 01 01 01 01 01 01 01 C9
C840:01 01 01 01 01 01 01 01 D1
C848:01 01 01 01 01 01 01 01 D9
C850:01 01 01 01 01 01 01 01 E1
C858:01 01 01 01 01 01 01 01 E9
C860:01 01 01 01 01 01 01 01 F1
C868:01 01 01 01 01 01 01 01 F9
C870:01 01 01 01 01 01 01 01 02
C878:01 01 01 01 01 01 01 01 0A
C880:01 01 01 01 01 01 01 01 12
C888:01 01 01 01 01 01 01 01 1A
C890:01 01 01 01 01 01 01 01 22
C898:01 01 01 01 01 01 01 01 2A
C8A0:01 01 01 01 01 01 01 01 32
C8A8:01 01 01 01 01 01 01 01 3A
C8B0:01 01 01 01 01 01 01 01 42
C8B8:01 01 01 01 01 01 01 01 4A
C8C0:01 01 01 01 01 01 01 01 52
C8C8:01 01 01 01 01 01 01 01 5A
C8D0:01 01 01 01 01 01 01 01 62
C8D8:01 01 01 01 01 01 01 01 6A
C8E0:01 01 01 01 01 00 00 00 6B
C8E8:00 00 00 00 00 00 00 00 7A
C8F0:00 00 00 00 00 00 00 00 82
C8F8:00 00 00 00 00 00 00 00 8A
C900:32 32 33 33 34 35 36 36 EB
C908:37 38 38 39 3A 3B 3B 3C 51
C910:3C 3D 3E 3F 3F 40 41 41 8B
C918:42 43 44 44 45 45 47 47 7F
C920:48 48 49 4A 4B 4C 4C 4D 29
C928:4D 4E 4F 50 50 51 52 52 A3
C930:53 54 55 55 56 56 58 58 97
C938:59 59 5A 5B 5C 5C 5D 5D 3D
C940:5E 5F 60 61 61 62 62 63 B9
C948:64 65 66 66 67 67 69 69 AF
C950:6A 6A 6B 6C 6D 6D 6E 6E 55
C958:6F 70 71 72 72 73 73 74 D1
C960:75 76 76 77 78 78 79 7A A5
C968:7B 7B 7C 7C 7E 7E 7F 80 5D
C970:80 81 82 83 83 84 84 85 E9
C978:86 87 87 88 88 89 89 8A BD
C980:8C 8C 8D 8D 8F 8F 90 90 74
C988:91 92 93 93 94 95 95 96 F1
C990:97 98 98 99 9A 9A 9B 9C D5
C998:9D 9D 9E 9E 9A 9A 9A 9A 8C
C9A0:A2 A3 A4 A4 A5 A6 A6 A7 0A
C9A8:A8 A9 A9 AA AA AB AC AD E5
C9B0:AD AE AF AF AF B0 B1 B2 1C
C9B8:B3 B4 B5 B5 B6 B7 B7 B8 22

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C9C0:B9 BA BA BB BB BC BD BE FD
 C9C8:BE BF C0 C0 C1 C2 C3 C3 34
 C9D0:C4 C4 C6 C6 C7 C7 C8 C9 F5
 C9D8:CA CA CB CC CC CD CE CF D5
 C9E0:CF D0 D1 D1 D2 D3 D4 D4 4C
 C9E8:D5 D5 D7 D7 D8 D8 D9 DA 0E
 C9F0:DB DB DC DD DD DE DF E0 ED
 C9F8:E0 E1 E1 E2 E3 E4 E5 E5 44
 CA00:E5 E4 E3 E2 E1 E1 E0 E0 A5
 CA08:DF DE DD DD DC DB DB DA C7
 CA10:D9 D8 D8 D7 D7 D5 D5 D4 F7
 CA18:D4 D3 D2 D1 D1 D0 CF CF C5
 CA20:CE CD CC CC CB CA CA C9 DF
 CA28:C8 C7 C7 C6 C6 C4 C4 C3 10
 CA30:C3 C2 C1 C0 C0 BF BE BE DD
 CA38:BD BC BB BB BA BA B9 B8 FB
 CA40:B7 B7 B6 B5 B5 B4 B3 B2 6C
 CA48:B2 B1 B0 AF AF AE AD AD F5
 CA50:AC AB AA AA A9 A8 A7 14
 CA58:A6 A6 A5 A4 A4 A3 A2 A1 84
 CA60:A1 A0 A0 9E 9E 9D 9D 9C 30
 CA68:9B 9A 9A 99 98 98 97 96 4C
 CA70:95 95 94 93 93 92 91 90 9C
 CA78:90 8F 8F 8D 8D 8C 8C 8B 48
 CA80:8A 89 89 88 87 87 86 85 64
 CA88:84 84 83 83 82 81 80 80 C5
 CA90:7F 7E 7E 7C 7C 7B 7B 7A 60
 CA98:79 78 78 77 76 76 75 74 7C
 CAA0:73 73 72 72 71 70 6F 6F DD
 CAA8:6E 6D 6D 6C 6B 6A 6A 69 88
 CAB0:69 67 67 66 66 65 64 63 1D
 CAB8:62 62 61 61 60 5F 5E 5E F5
 CAC0:5D 5C 5C 5B 5A 59 59 58 A0
 CAC8:58 56 56 55 55 54 53 52 35
 CAD0:52 51 50 50 4F 4E 4D 4D 8E
 CAD8:4C 4C 4B 4A 49 48 48 47 F8
 CAE0:47 45 45 44 44 43 42 41 4D
 CAE8:41 40 3F 3F 3E 3D 3C 3C A6
 CAF0:3B 3B 3A 39 38 38 37 36 15
 CAF8:36 35 34 33 33 32 32 39 B0

Bill Soudan manipulates sprites in *Gi-rard, Pennsylvania*.

MIDWAY COMMAND

By Michael Sedlezky

Midway Command is a two-player strategy game for the 64. You and a friend assume the roles of American and Japanese naval commanders during World War II.

Experience the Battle of Midway as each of you orders your powerful carrier forces into battle with each other. Your flotilla is made up of battleships, cruisers, destroyers, and aircraft carriers. There are 14 vessels per side. Winning the game is accomplished by sinking your enemy's carrier. Your ships battle each other with cannon shells.

Midway Command is written entirely in machine language, but it loads and runs like a BASIC program. To enter it, use MLX, our machine language entry pro-

gram. See "Typing Aids" elsewhere in this section. When MLX prompts, respond with the following values.

Starting address: 0801

Ending address: 1680

The game is played on a grid that resembles a standard checkerboard. Each occupied square contains a marker that indicates a ship. The American marker is black, and the Japanese marker is white.

Use your joystick in port 2 to position the game's cursor to select a square of your choice. As the cursor moves over a square, a view of the ship is displayed along with its type and two scale bars.

Ship Strength

One scale represents the ship's strength. This scale represents the amount of damage the ship can withstand. As the scale decreases in size, the ship is in danger of sinking. Damage inflicted on any ship cannot be repaired.

Ship Firepower

The firepower scale represents the amount of damage the ship's guns will inflict on an enemy vessel's strength. This scale will increase if this ship fires the blow that sinks an enemy ship. As a ship gains experience, it becomes a deadlier fighting vessel.

Playing the Game

The game is played in turns. Each player has the option either to move or to attack. The American commander starts first. You choose one of your ships by selecting it with the cursor and then pressing the fire button. You then have the option either to move or to fight by pressing a function key. Follow on-screen directions.

You finish a turn by selecting a target square. The cursor is a green shade if the target square is within legal boundaries. In order for you to move onto a square, it must be unoccupied and within range. The border flashes red if you attempt an illegal move.

Moving and Firing

All ships can move at least one square in any direction. Destroyers can move two.

To attack, you must select an enemy ship that is within firing range. Each ship has different ranges, and you can fire in any direction. The carrier cannot fire. A destroyer can fire a distance of only one square. Cruisers can fire two squares only; they cannot fire one square. A battleship can fire one or two squares. The battleship is your strongest piece, followed by the cruisers and then by destroyers. Protect your carrier at all times.

Game Hints

Whenever possible, force the enemy to move into your range of fire so you can get first shot. Use your cruiser or battleship to finish off an enemy so you can increase your stronger piece's firepower.

Fight cruisers with destroyers. Use the destroyers' two-square advantage to jump to an adjoining square where the cruiser can't fire on you.

If your opponent takes a defensive strategy, analyze the setup and probe the weakest side with your destroyers. Attack from different sides and try to draw the ships out of position.

MIDWAY COMMAND

0801:0C 08 01 00 9E 20 33 33 48
 0809:32 39 00 00 00 00 27 1D EB
 0811:13 09 1D 27 27 27 1D 1D 30
 0819:27 27 27 27 00 00 26 24 4E
 0821:22 28 24 26 26 26 24 24 69
 0829:26 26 26 26 00 19 03 00 67
 0831:00 80 00 FA 0B 0F 0C 00 BD
 0839:00 00 00 00 00 00 8F 00 68
 0841:00 00 00 00 00 00 00 00 51
 0849:00 00 00 00 00 00 00 00 59
 0851:00 00 18 00 00 82 80 00 6F
 0859:AA 40 02 7C 80 05 FF 40 2F
 0861:00 7C 00 00 00 00 00 00 90
 0869:00 00 00 00 00 00 00 00 79
 0871:00 00 00 00 00 00 00 00 81
 0879:00 00 00 00 00 00 87 00 98
 0881:00 00 00 00 00 00 00 00 91
 0889:00 00 00 00 00 00 00 00 99
 0891:01 00 00 03 00 00 33 00 B8
 0899:03 FF 00 79 FF 00 3F FF 41
 08A1:FF FF FF 3F FF FF 0F FF C3
 08A9:FF 07 FF FF 00 00 00 00 7B
 08B1:00 00 00 00 00 00 00 00 C1
 08B9:00 00 00 00 00 00 80 00 CA
 08C1:00 00 00 00 00 00 00 00 D1
 08C9:80 00 00 C0 00 00 80 00 27
 08D1:00 D0 00 00 90 00 00 D7 72
 08D9:C0 00 FF 9C 00 FF FF 80 94

PROGRAMS

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08E1:FF FE 30 FF FF FF FF FF B7
08E9:FF FF FF FE 00 00 00 00 E9
08F1:00 00 00 00 00 00 00 02
08F9:00 00 00 00 00 00 80 0B
0901:00 00 00 00 00 00 00 13
0909:00 00 00 00 00 00 00 1B
0911:00 00 00 00 00 00 00 23
0919:00 01 00 00 1F 7F 0C CF 4A
0921:3F FF FF 1F FF FF 0F FF E2
0929:FF 07 FF FF 00 00 00 00 FC
0931:00 00 00 00 00 00 00 43
0939:00 00 00 00 00 00 80 00 4C
0941:00 00 00 00 00 00 00 53
0949:00 00 00 00 00 00 00 5B
0951:00 80 00 00 90 00 00 D3 DB
0959:00 00 FF 9C 00 FF FC 00 2F
0961:FF FF 00 FF FF FE FF FF 6F
0969:FE FF FF FC 00 00 00 00 CA
0971:00 00 00 00 00 00 00 83
0979:00 00 00 00 00 00 80 00 8C
0981:00 00 00 00 00 00 00 93
0989:00 00 00 00 00 00 00 9B
0991:00 00 00 00 00 00 00 A3
0999:00 01 00 00 03 00 00 0F 13
09A1:00 06 7F 01 FF FF 00 7F B4
09A9:FF 00 3F FF 00 00 00 00 A3
09B1:00 00 00 00 00 00 00 C3
09B9:00 00 00 00 00 00 80 00 CC
09C1:00 00 00 00 00 00 00 D3
09C9:00 00 00 00 00 00 00 DB
09D1:00 00 00 00 00 00 00 E3
09D9:00 00 00 00 00 C0 00 00 EE
09E1:F8 00 00 FD CC 00 FF FF B6
09E9:80 FF FF 00 00 00 00 3C
09F1:00 00 00 00 00 00 00 04
09F9:00 00 00 00 00 00 80 00 0D
0A01:00 00 00 00 00 00 00 15
0A09:00 00 00 00 00 00 00 1D
0A11:00 00 00 00 00 00 01 00 27
0A19:00 6D FF FF FF 0F FF FF C4
0A21:FF FF FF FF FF FF 7F FF 34
0A29:FF 3F FF FF 00 00 00 00 45
0A31:00 00 00 00 00 00 00 4E
0A39:00 00 00 00 00 00 80 00 55
0A41:00 00 00 00 00 00 00 5E
0A49:00 00 00 00 00 00 80 00 62
0A51:00 80 00 00 B0 00 00 F6 02
0A59:C0 00 FF FF FF FF FF F0 BE
0A61:FF FF FF FF FF FF FF 75
0A69:FE FF FF FC 00 00 00 00 CC
0A71:00 00 00 00 00 00 00 85
0A79:00 00 00 00 00 00 80 00 8E
0A81:00 00 00 00 00 00 00 95
0A89:00 00 00 00 00 00 00 9D
0A91:01 00 00 00 00 00 01 00 28
0A99:00 05 00 00 FF 00 00 3F 2E
0AA1:00 0F FF FF C3 FF 7F FF 96
0AA9:FF 7F FF FF 00 00 00 00 9D
0AB1:00 00 00 00 00 00 00 C5
0AB9:00 00 00 00 00 00 8F 00 EC
0AC1:00 00 00 00 00 00 00 D5
0AC9:00 00 00 C0 00 00 00 80 EA
0AD1:00 C4 00 00 AC 00 00 CF 4C
0AD9:00 00 AC 70 00 FE E0 00 48
0AE1:FF FF 00 FF FC 0F FF FF 1A
0AE9:FF FF FF FE 00 00 00 00 ED
0AF1:00 00 00 00 00 00 00 06
0AF9:00 00 00 00 00 00 8F 00 2D
0B01:00 00 00 00 00 00 00 17
0B09:00 00 00 00 00 00 00 1F
0B11:00 00 00 00 00 00 00 27
0B19:08 01 00 04 03 00 33 CF 02
0B21:7F 0F FF 7F FF FF 3F FF 31
0B29:FF 0F FF FF 00 00 00 00 03
0B31:00 00 00 00 00 00 00 47
0B39:00 00 00 00 00 00 8F 00 6E
0B41:00 00 00 00 00 00 00 57
0B49:00 00 03 00 00 00 00 5F
0B51:00 80 00 00 C0 00 00 D8 66
0B59:00 00 98 90 00 F8 E2 00 35
0B61:FF FC 00 FF FF F0 FF FF 7A
0B69:F0 FF FF F0 00 00 00 00 07
0B71:00 00 00 00 00 00 00 87
0B79:00 00 00 00 00 00 8F 00 AE
0B81:00 00 00 00 00 00 00 97
0B89:00 00 00 00 00 00 00 9F
0B91:00 00 00 00 00 00 00 A7
0B99:00 00 00 00 01 00 00 01 B8
0BA1:00 00 9D 00 00 7F 00 3F A8
0BA9:FF 00 1F FF 00 00 00 00 A3
0BB1:00 00 00 00 00 00 00 C7
0BB9:00 00 00 00 00 00 8F 00 EE
0BC1:00 00 00 00 00 00 00 D7
0BC9:00 00 00 00 00 00 00 DF
0BD1:00 00 00 00 00 00 80 68
0BD9:00 00 00 00 00 40 00 00 F0
0BE1:60 10 00 E2 E7 00 FF FE 98
0BE9:00 FF FE 00 00 00 00 00 DF
0BF1:00 00 00 00 00 00 00 08
0BF9:00 00 00 00 00 00 8F 00 2F
0C01:00 00 00 00 00 00 00 19
0C09:00 00 00 00 00 01 00 00 25
0C11:01 00 00 03 00 00 03 00 DF
0C19:00 17 FF FF FF 42 1C 7F B7
0C21:43 3F FF FF FF FF 7F FF A9
0C29:FF 3F FF FF FF 00 00 11
0C31:00 00 00 00 00 00 00 49
0C39:00 00 00 00 00 00 8F 00 70
0C41:00 00 00 00 00 00 00 59
0C49:00 00 00 00 00 00 00 61
0C51:00 00 00 00 80 00 00 82 EF
0C59:A5 28 FF FF FE FF F8 44 7C
0C61:FF FC 44 FF FF FF FF FF 41
0C69:FE FF FF FE 00 00 00 00 F0
0C71:00 00 00 00 00 00 00 89
0C79:00 00 00 00 00 00 8F 00 B0
0C81:00 00 00 00 00 00 00 99
0C89:00 00 00 00 00 00 10 F1
0C91:00 00 08 00 00 10 00 00 EA
0C99:28 00 00 38 00 00 7C 00 42
0CA1:00 6C 00 00 38 00 00 38 CE
0CA9:00 00 00 00 00 00 00 C9
0CB1:00 00 00 00 00 00 00 D2
0CB9:00 00 00 00 00 00 80 00 D2
0CC1:00 00 00 00 00 01 00 DB
0CC9:00 04 00 00 00 00 00 8A EA
0CD1:00 00 10 00 00 28 00 00 8C
0CD9:38 00 00 7C 00 00 6C 00 AE
0CE1:00 7C 00 00 6C 00 00 38 B4
0CE9:00 00 00 00 00 00 00 02
0CF1:00 00 00 00 00 00 00 0A
0CF9:00 00 00 00 00 00 80 00 13
0D01:A9 FF 85 FE 85 FC A9 D2 D6
0D09:85 FF A9 22 85 FD A0 00 A2
0D11:8C 0E DC A9 33 85 01 B1 8E
0D19:FE 91 FC C6 FC C6 FE D0 F4
0D21:F6 C6 FD C6 FF A5 FF C9 F4
0D29:CF D0 EC A9 37 85 01 A9 13
0D31:01 8D 0E DC 8D 0B CF A9 A0
0D39:18 8D 18 D0 A2 32 BD 80 AC
0D41:0E 9D 07 21 CA D0 F7 A9 EF
0D49:93 20 D2 FF 20 D7 11 A9 BB
0D51:0B 8D 35 08 20 90 13 A2 87
0D59:0D BD A9 0E 9D 19 04 A9 82
0D61:07 9D 19 D8 CA 10 F2 20 B3
0D69:F7 15 A9 00 8D 12 CF 8D DB
0D71:13 CF 8D 19 CF 8D 2D CF 2B
0D79:8D 2E CF 8D 76 16 A2 0D 17
0D81:A0 1B 20 A5 0F 20 3A 10 8E
0D89:AD 12 CF D0 DD A9 00 8D 29
0D91:19 CF AD 0C CF F0 11 20 27
0D99:47 0E 20 C3 11 A9 09 8D E9
0DA1:35 08 20 90 13 4C AF 0D 9B
0DA9:20 AD 10 4C 9B 0D A9 04 6E
0DB1:8D 24 CF 20 2D 0E AD 23 B7
0DB9:CF F0 14 A2 8B A0 53 20 4A
0DC1:86 10 20 E4 FF C9 85 D0 78
0DC9:F9 20 10 16 4C 01 0D A9 76
0DD1:01 8D 2E CF 8D 76 16 A2 A7
0DD9:0D A0 A7 A9 00 8D 12 CF 5C
0DE1:8D 13 CF 8D 19 CF A9 10 C5
0DE9:8D 2D CF 20 A5 0F 20 3A F5
0DF1:10 AD 12 CF D0 D9 A9 00 FF
0DF9:8D 19 CF AD 0C CF F0 11 88
0E01:20 47 0E 20 C3 11 A9 0B 83
0E09:8D 35 08 20 90 13 4C 18 BD
0E11:0E 20 AD 10 4C 04 0E A9 2B
0E19:14 8D 24 CF 20 2D 0E AD A3
0E21:23 CF F0 05 A2 99 4C BE 04
0E29:0D 4C 6B 0D A9 00 8D 23 A8
0E31:CF A2 3F BD 50 78 29 1F 77
0E39:CD 24 CF F0 08 CA 10 F3 CD
0E41:A9 01 8D 23 CF 60 AE 11 C4
0E49:CF BD 50 78 8D 14 CF BD 68
0E51:90 78 9D 00 78 BD D0 78 5C
0E59:8D 29 CF A9 00 9D 50 78 AA
0E61:9D D0 78 AE 04 CF 8E 07 FD
0E69:CF AD 76 16 8D 08 CF 9D D2
0E71:00 78 AD 14 CF 9D 50 78 B0
0E79:AD 29 CF 9D D0 78 60 AA 5E
0E81:55 AA 55 AA 55 AA 55 AA F2
0E89:55 AA 55 AA 55 AA 55 AA FA
0E91:55 AA 55 AA 55 AA 55 FF 58
0E99:FF 81 99 BD BD 99 81 FF 7C
0EA1:FF FF FF FF FF FF FF FF BD
0EA9:0D 09 04 17 01 19 20 03 30
0EB1:0F 0D 0D 01 0E 04 20 10 1B
0EB9:0C 05 01 13 05 20 13 05 42
0EC1:0C 05 03 14 20 01 0D 05 EA
0EC9:12 09 03 01 0E 20 13 08 C0
0ED1:09 10 06 31 20 20 06 09 E0
0ED9:12 05 20 07 15 0E 13 20 DB
0EE1:06 37 20 20 0D 0F 16 05 AA
0EE9:20 13 08 09 10 20 20 14 C1
0EF1:01 12 07 05 14 20 13 11 9C
0EF9:15 01 12 05 20 06 31 20 0F
0F01:03 0F 0E 14 09 0E 15 05 17
0F09:20 20 20 20 06 09 12 09 C6
0F11:0E 07 20 13 09 12 20 20 1E
0F19:20 01 20 04 09 12 05 03 69
0F21:14 20 08 09 14 20 13 08 32
0F29:05 20 09 13 20 13 09 0E 91
0F31:0B 09 0E 07 20 01 0D 05 6D
0F39:12 09 03 01 20 17 09 0E 90
0F41:13 20 20 20 0A 01 10 01 6C
0F49:0E 20 17 09 0E 13 20 20 07
0F51:20 0A 01 10 01 0E 05 13 80
0F59:05 20 13 08 09 10 06 09 82
0F61:12 05 20 10 0F 17 05 12 BF
0F69:20 13 14 12 05 0E 07 14 82

```


0F71:08 20 15 0E 0F 03 03 15 BE	11A1:8D 15 D0 AE 04 CF BD D0 80	13D1:03 CF C9 7E D0 06 20 B5 23
0F79:10 09 05 04 20 03 01 12 E3	11A9:78 09 80 9D D0 78 20 E0 BD	13D9:14 4C ED 13 AD 03 CF 29 4E
0F81:12 09 05 12 20 20 02 01 33	11B1:14 A0 0A 20 CA 11 88 10 05	13E1:02 D0 06 20 C9 14 4C ED 25
0F89:14 14 0C 05 13 08 09 10 63	11B9:FA A9 00 8D 06 D4 8D 04 3F	13E9:13 4C A7 13 AE 07 CF AD B1
0F91:20 03 12 15 09 13 05 12 C4	11C1:D4 60 A9 96 85 FE 4C CE 94	13F1:08 CF 9D 00 78 20 6E 14 F8
0F99:20 20 04 05 13 14 12 0F BC	11C9:11 A9 23 85 FE C6 FF D0 7F	13F9:AD 04 CF 29 3F 8D 04 CF 8C
0FA1:19 05 12 20 20 86 10 A9 B6	11D1:FC C6 FE D0 F8 60 A0 07 A2	1401:8D 07 CF 20 E0 14 AE 04 66
0FA9:00 8D 10 CF 8D 19 CF 20 BA	11D9:84 FD A9 04 85 FE A9 26 D4	1409:CF BD 00 78 8D 08 CF AD E9
0FBL:9A 13 AE 04 CF BD 50 78 86	11E1:85 FF A2 00 8E 04 CF 8E CD	1411:10 CF F0 1B AD 0D CF CD 14
0FB9:8D 2C CF F0 EA 29 10 CD 9C	11E9:05 CF 8E 06 CF A0 07 18 DB	1419:0F CF 90 03 4C 28 14 AD D7
0FC1:2D CF F0 E3 8E 11 CF 8E AD	11F1:A5 FF 69 03 85 FF 9D 40 EB	1421:0E CF CD 0F CF 90 19 A9 8B
0FC9:19 CF 8E 2B CF BD 00 78 7C	11F9:CE A5 FE 69 00 85 FE 9D 15	1429:0A 8D 13 CF 4C 62 14 BD EA
0FD1:8D 2A CF 4A 4A 4A 29 07 B4	1201:00 CE E8 88 10 E9 18 A5 7C	1431:50 78 F0 07 29 10 CD 2D 80
0FD9:8D 1E CF A9 00 8D 0C CF F8	1209:FF 69 60 85 FF A5 FE 69 E9	1439:CF D0 05 A9 0A 4C 62 14 13
0FEL:8D 30 CF 85 C6 A2 29 A0 D8	1211:00 85 FE C6 FD 10 D6 A2 63	1441:AD 30 CF F0 15 AD 0D CF 9E
0FE9:37 20 86 10 20 E4 FF C9 DB	1219:3F A9 01 8D 09 CF A9 07 22	1449:F0 10 C9 04 F0 0C AD 0E 88
0FF1:85 D0 26 AD 2C CF 29 7F 19	1221:8D 0A CF A9 00 9D 80 CE 69	1451:CF F0 07 C9 04 F0 03 4C 51
0FF9:4A 4A 4A 4A 4A 8D 0D CF 30	1229:9D C0 CE 9D C0 CF 9D 50 D0	1459:28 14 A9 00 8D 13 CF A9 D1
1001:8D 0E CF 0A 8D 0F CF EE 3D	1231:78 8D 23 CF AD 09 CF 49 D0	1461:0D 8D 77 16 9D 00 78 20 C1
1009:0F CF AD 2C CF 29 0F AA 09	1239:01 8D 09 CF A8 B9 36 08 FF	1469:6E 14 4C 9A 13 A2 3F A0 43
1011:BD E2 12 F0 03 8D 30 CF 98	1241:9D 00 78 9D 90 78 CE 0A 2B	1471:00 BD 40 CE 85 FE BD 00 A1
1019:60 C9 88 D0 CF A2 03 A0 A9	1249:CF 10 0D AD 09 CF 49 01 F0	1479:CE 85 FF BD 50 78 F0 04 90
1021:01 8C 0C CF AD 2C CF 29 4A	1251:8D 09 CF A9 07 8D 0A CF 65	1481:A9 24 91 FE A5 FF 18 69 70
1029:80 F0 04 A0 02 A2 05 8C 81	1259:CA 10 C8 A2 0D BD 9C 12 D4	1489:D4 85 FF BD 00 78 91 FE 5D
1031:0D CF 8C 0E CF 8E 0F CF E4	1261:9D E0 CF A8 BD B8 12 99 9F	1491:CA 10 DE 60 AD 05 CF F0 17
1039:60 A2 0D 8E 10 CF A0 45 03	1269:50 78 A9 01 99 00 78 BD 94	1499:09 CE 04 CF CE 05 CF CE 70
1041:20 86 10 20 9A 13 AE 04 99	1271:D4 12 99 D0 78 BD AA 12 E6	14A1:0D CF 60 AD 05 CF C9 07 2D
1049:CF EC 11 CF F0 1D AD 13 16	1279:9D F0 CF A8 BD C6 12 99 F3	14A9:F0 09 EE 04 CF EE 05 CF BE
1051:CF D0 18 AD 0C CF D0 D0 B9	1281:50 78 A9 00 99 00 78 BD 9C	14B1:EE 0D CF 60 AD 06 CF F0 AA
1059:BD 50 78 F0 0E 29 10 CD 8D	1289:D4 12 09 40 99 D0 78 CA 8D	14B9:0E AD 04 CF E9 08 8D 04 60
1061:2D CF D0 07 60 BD 50 78 A9	1291:10 CB A9 01 8D 07 CF 8D AB	14C1:CF CE 06 CF CE 0E CF 60 F1
1069:D0 01 60 A9 0A 8D 20 D0 70	1299:08 CF 60 00 01 03 04 06 E3	14C9:AD 06 CF C9 07 F0 0F AD A8
1071:A0 07 20 CA 11 88 10 FA 1A	12A1:07 09 0A 0B 0C 0D 0E 13 41	14D1:04 CF 18 69 08 8D 04 CF D7
1079:AD 35 08 8D 20 D0 8D 12 09	12A9:14 38 39 3B 3C 3E 3F 31 4B	14D9:EE 06 CF EE 0E CF 60 AE 03
1081:CF 20 90 13 60 8C 28 CF 2A	12B1:32 33 34 35 36 2B 2C A1 ED	14E1:04 CF BD D0 78 8D 25 CF D8
1089:A0 0D BD B7 0E 99 69 04 1E	12B9:42 43 04 45 A6 A7 A8 49 13	14E9:BD 50 78 29 0F D0 03 4C B4
1091:A9 0F 99 69 D8 99 B9 D8 8D	12C1:4A AB AC AD AE B1 52 53 9A	14F1:D8 15 AA BD 1E 08 8D 18 41
1099:CA 88 10 EE AE 28 CF A0 88	12C9:14 55 B6 B7 B8 59 5A BB 3B	14F9:CF BD 0E 08 AA A0 09 BD 63
10A1:0D BD B7 0E 99 B9 04 CA 16	12D1:BC BD BE 0B 15 27 04 15 AE	1501:7D 0F 99 D3 05 A9 25 99 D0
10A9:88 10 F6 60 AD 15 D0 09 63	12D9:0B 0B 0B 15 15 0B 0B 0B EE	1509:83 05 99 AB 05 A9 03 99 92
10B1:01 8D 15 D0 A2 61 A0 6F B0	12E1:0B 00 00 01 00 00 01 00 9D	1511:D3 D9 99 9B DA 99 3B DB 18
10B9:20 86 10 A0 05 20 CA 11 E6	12E9:00 00 01 01 00 00 00 00 3E	1519:A9 0A 99 EB DA 99 8B DB BC
10C1:88 10 FA 20 70 11 A0 19 AD	12F1:A9 04 85 FF A9 00 85 FE F3	1521:AD 35 08 99 83 D9 99 AB 6C
10C9:20 CA 11 88 D0 FA 20 09 13	12F9:A2 17 A9 02 8D 02 CF A9 48	1529:D9 A9 FF 8D 1B D0 B9 5F 72
10D1:11 AE 04 CF AD 20 CF F0 22	1301:21 8D 01 CF A0 17 A9 02 EE	1531:0F 99 9B 06 B9 69 0F 99 48
10D9:05 A9 01 4C FF 10 20 52 9E	1309:8D 00 CF AD 01 CF 91 FE 34	1539:3B 07 A9 20 99 EC 06 99 20
10E1:11 AE 11 CF AD 2A CF 9D A8	1311:CE 00 CF 10 0D AD 01 CF 8A	1541:8C 07 CA 88 10 B9 AD 25 3D
10E9:D0 78 AE 04 CF A9 00 9D 69	1319:49 03 8D 01 CF A9 02 8D 1D	1549:CF 29 40 F0 08 A0 00 AD 2D
10F1:50 78 8D 25 CF BD 90 78 6B	1321:00 CF 88 10 E6 CE 02 CF 93	1551:18 CF 4C 5E 15 A0 0F AD E1
10F9:9D 00 78 8D 08 CF AD 25 D0	1329:10 0D A9 02 8D 02 CF AD B1	1559:18 CF 18 69 08 8D F9 07 8E
1101:CF 9D D0 78 20 E0 14 60 21	1331:01 CF 49 03 8D 01 CF A5 DA	1561:18 69 01 8D FA 07 A9 21 53
1109:A9 01 8D 20 CF AD 27 CF 47	1339:FE 18 69 28 85 FE A5 FF 08	1569:8D F8 07 A9 FF 8D 02 0D 1F
1111:ED 1E CF 8D 27 CF 30 0C 69	1341:69 00 85 FF CA 10 BD A9 88	1571:A9 17 8D 04 D0 A9 12 8D 07
1119:AD 25 CF 29 F8 0D 27 CF 02	1349:00 85 FE 85 FC A9 04 85 25	1579:0E D0 8D 00 D0 A9 6B 8D 22
1121:8D 25 CF 60 A9 00 8D 20 DB	1351:FF A9 D8 85 FD A9 17 8D A7	1581:03 D0 8D 05 D0 8D 0F D0 0F
1129:CF 8D 25 CF A2 61 A0 7D 91	1359:10 CF A0 17 B1 FE 29 01 DD	1589:8D 01 D0 8C 28 D0 8C 29 64
1131:20 86 10 AD 2A CF 29 C7 8C	1361:AA BD 36 08 91 FC 88 10 35	1591:D0 8C 2E D0 A9 07 8D 27 C5
1139:8D 2A CF EE 1E CF AD 1E 3F	1369:F3 A5 FE 18 69 28 85 FE 4A	1599:D0 A9 85 8D 10 D0 AD 25 64
1141:CF C9 08 D0 02 A9 07 0A 9A	1371:85 FC A5 FE 18 69 00 85 FE 4A	15A1:CF 29 80 F0 05 A9 86 4C 45
1149:0A 0A 0D 2A CF 8D 2A CF 10	1379:18 69 D4 85 FD CE 10 CF 14	15A9:AD 15 A9 06 8D 15 D0 AD 95
1151:60 A0 0E 20 CA 11 20 CA 35	1381:10 D8 AD 35 08 8D 20 D0 76	15B1:25 CF 29 07 AA 8D 27 CF A1
1159:11 20 CA 11 EE 01 D0 EE 82	1389:8D 21 D0 20 6E 14 60 20 7F	15B9:A9 25 9D 8C 07 CA 10 F8 FA
1161:03 D0 EE 05 D0 EE 0F D0 98	1391:F1 12 20 6E 14 20 E0 14 17	15C1:AD 25 CF 4A 4A 4A 29 07 7F
1169:88 10 E8 20 D8 15 60 A2 71	1399:60 AD 00 DC C9 7F F0 06 5D	15C9:AA 8D 26 CF F0 08 A9 25 8E
1171:0F A9 00 9D 00 D4 CA 10 58	13A1:20 CA 11 4C 9A 13 C6 FE 1F	15D1:9D EC 06 CA 10 F8 60 A0 39
1179:F8 A2 06 BD 2E 08 9D 00 2A	13A9:D0 FC AD 00 DC 8D 03 CF 20	15D9:09 B9 73 0F 99 D3 05 A9 26
1181:D4 CA 10 F7 A9 08 8D 18 E2	13B1:29 10 D0 01 60 AD 03 CF 2A	15E1:20 99 83 05 99 AB 05 99 62
1189:D4 A9 81 8D 04 D4 20 CA 08	13B9:29 04 D0 06 20 95 14 4C BB	15E9:8C 07 99 EC 06 88 10 F9 7A
1191:11 A9 80 8D 04 D4 A9 01 57	13C1:ED 13 AD 03 CF 29 08 D0 8D	15F1:A9 00 8D 15 D0 60 78 AD 9A
1199:8D 01 D4 AD 15 D0 29 FE 75	13C9:06 20 A4 14 4C ED 13 AD BE	15F9:14 03 8D 73 16 AD 15 03 6C


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1601:8D 74 16 A9 1F 8D 14 03 C8
1609:A9 16 8D 15 03 58 60 78 45
1611:AD 73 16 8D 14 03 AD 74 09
1619:16 8D 15 03 58 60 CE 78 E0
1621:16 10 4C A9 0F 8D 78 16 36
1629:AD 7A 16 49 01 8D 7A 16 6B
1631:8D FF 07 29 01 8D 79 16 DE
1639:A0 00 AD 19 CF F0 16 AA 16
1641:BD 00 CE 18 69 D4 85 D4 26
1649:BD 40 CE 85 D3 AE 79 16 F8
1651:BD 75 16 91 D3 AE 04 CF C6
1659:BD 00 CE 18 69 D4 85 D4 3E
1661:BD 40 CE 85 D3 AD 77 16 09
1669:49 08 91 D3 8D 77 16 4C 6E
1671:31 EA 00 00 05 00 05 00 23
1679:00 32 00 00 00 00 00 32

```

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CHASE

By Jon Piltingsrud

You're at home, quietly studying with a friend, when a fanfare of noise erupts from your 64. It announces the arrival of a message from aliens who have taken control of your computer. The communiqué informs you that the advanced race has sent the two of you something important: a game! Before you know it, you and your friend are in deadly competition on the game's playing field.

Chase is an arcade-style, two-player game for the 64 that requires two joysticks. The game consists of two programs: Chase, a BASIC loader; and Chase ML, a machine language program. To help avoid typing errors, enter Chase with The Automatic Proofreader. See "Typing Aids" elsewhere in this section. Be sure to save a copy of the program before you try to run it.

Chase ML is written in machine language. Use MLX, our machine language entry program, to enter it. When MLX prompts, respond with the following starting and ending addresses.

Starting address: 2795

Ending address: 3484

Be sure to save the ML program with the filename CHASE ML on the same disk as Chase. Chase automatically loads this program when it runs and searches for that filename.

The Rules

When you run Chase, you'll see the message from the aliens. After you've read it, press any key, and you and your opponent will be on the playing field. One player operates the red disk and the other the yellow one.

You'll see your weapons on the field. They resemble footballs. Each weapon is colored to match one of the players. The idea simply is to pick up your weapon and touch your opponent, thereby destroying him.

While the rules may be simple, executing the game plan isn't. Your opponent will be trying to avoid you until he is armed. As powerful as these weapons are, they have a few quirks. You can hold them for only a few seconds before they fly from your grasp and land on another part of the screen.

As you chase after your weapon, you may reach your opponent's first. If you touch your opponent's weapon, it will jump to a random location on the screen. To make the chase more interesting, each field has a number of obstacles scattered about it.

To quit the game and see a tally of each player's kills, press the Q key. From the score screen, press either of the joystick fire buttons to resume.

CHASE

```

CS 10 REM COPYRIGHT 1993 - COM
    PUTE PUBLICATIONS INLT L
    TD - ALL RIGHTS RESERVED
RB 12 IFA=0 THEN A=1:LOAD"CHASE
    {SPACE}ML",8,1
HQ 14 POKE56,39:CLR:A=RND(-TI)
    :C=65520
FD 16 S=54272:D=56576:E=53272:
    F=53265
MC 18 POKEF,0:POKE53280,0:POKE
    53281,0
PM 20 FORL=0 TO 23:POKE5+L,0:NEX
    T
HQ 22 PRINT "{CLR}{6}{DOWN}";:A
    $="!$%&()*+,-.CHR$(34)
EA 24 POKE5+24,15:POKE5+18,128
BB 26 POKE5+6,255:POKE5+2,255:
    POKE5+4,83
HB 28 POKE5+15,RND(0)*5+1
BC 30 POKED,PEEK(D)OR3:POKEE,2
    8:POKEF,27
JG 32 FORW=0 TO 3:FORL=0 TORND(0)
    *4
QX 34 PRINTMIDS(AS,INT(RND(0)*
    11+1),1);
MC 36 POKE5+L,PEEK(S+27)/8:FOR
    T=1 TO 50:NEXT
CX 38 NEXTL:PRINT " ";:NEXTW

```

```

ER 40 PRINTCHR$(13)CHR$(145)TA
    B(18);
MB 42 READB$:IFB$<>"Z"THENPRIN
    TB$:GOTO32
HH 44 READB$:PRINTB$:POKE5+18,
    0:POKE5+4,0
AD 46 POKE198,0:WAIT198,1
DJ 48 :
RR 50 POKE820,0:POKE821,0:SYS1
    0133
XS 52 POKEF,0:PRINT "{CLR}"
GD 54 POKE781,9:POKE782,9:POKE
    783,0:SYSC
RQ 56 PRINTTAB(9)" {GRN}////////
    ///////////"
RJ 58 PRINTTAB(9)" {RED}PLAYER
    {SPACE}ONE'S SCORE:";
EQ 60 A=PEEK(820):PRINTA:PRINT
HP 62 PRINTTAB(9)" {YEL}PLAYER
    {SPACE}TWO'S SCORE:";
XC 64 B=PEEK(821):PRINTB:PRINT
    :PRINTTAB(9)
QA 66 IFA>B THEN PRINT "{GRN}
    {3 SPACES}PLAYER ONE WIN
    S["
AE 68 IFA<B THEN PRINT "{GRN}
    {3 SPACES}PLAYER TWO WIN
    S["
JR 70 IFA=B THEN PRINT "{GRN}
    {2 SPACES}THE GAME IS TI
    ED."
HS 72 PRINTTAB(9)"/////////"
    ///////////"
GP 74 POKE781,24:POKE782,8:POK
    E783,0:SYSC
GK 76 AS$="PRESS FIRE TO PLAY A
    GAIN"
RG 78 POKED,PEEK(D)OR3:POKEE,2
    8:POKEF,27
AG 80 PRINTTAB(8)" {GRN}";
GE 82 A=40:GOSUB90:IFB=1 THEN 50
QR 84 PRINTTAB(8)" {BLK}";
FE 86 A=10:GOSUB90:IFB=1 THEN 50
SK 88 GOTO80
EJ 90 PRINTAS$;" {UP}":B=0:X=1
HM 92 IF(PEEK(56320)AND16)=0 TH
    ENB=1
CK 94 IF(PEEK(56321)AND16)=0 TH
    ENB=1
CH 96 IFB=0 THEN X=X+1:IFX<>ATHE
    N92
SG 98 RETURN
EM 100 DATA LIVE BROADCAST WIT
    H
HM 102 DATA GAZETTE'S TACHYON
AK 104 DATA IMPULSE COPYRIGHT
CQ 106 DATA CIRCA 1993. . . @@@
    @@@@
BA 108 DATA GREETINGS FROM THE
GM 110 DATA PLANET +$%*&$().
    @@@@
JH 112 DATA WE ARE WELL PLEASE
    D
XE 114 DATA TO BRING YOU THIS
JF 116 DATA GAME PLAYED BY THE
BF 118 DATA COOL GUYS AND GALS
BA 120 DATA ON INHABITED PLANE

```


TS
 CJ 122 DATA THROUGHOUT THE KNO
 WN
 CH 124 DATA STELLAR SYSTEM.@@@
 @@@@
 FX 126 DATA WITHIN MOMENTS THI
 S
 ER 128 DATA TWO PLAYER MARVEL
 DB 130 DATA WILL BE TRANSFERRE
 D
 AS 132 DATA TO YOUR REMOTE 64.
 @@@@
 GS 134 DATA FORTUNATELY ENOUGH
 HA 136 DATA FOR YOU- WE HAVE M
 ADE
 CK 138 DATA IT POSSIBLE TO PLA
 Y
 JM 140 DATA ON YOUR PRIMITIVE-
 JA 142 DATA ALBEIT JUGGERNAUT-
 FR 144 DATA COMPUTER INTERFACE
 .@@@
 CA 146 DATA COINCIDENTALLY- TH
 E
 RS 148 DATA AUTHORS ALSO HAPPE
 N
 BX 150 DATA TO BE AMONG YOU.@@
 @@@@
 QJ 152 DATA THEIR NAME'S ARE.
 {SPACE}.
 RA 154 DATA TODD PILTINGSRUD A
 ND
 SX 156 DATA JON{2 SPACES}PILTI
 NGRUD.@@@@
 EM 158 DATA IF YOU HAPPEN TO R
 UN
 AK 160 DATA INTO THEM- TELL TH
 EM
 FS 162 DATA TO PHONE HOME.@@@
 @@@@
 EJ 164 DATA Z,... .END OF MESS
 AGE

CHASE ML

2795:A9 0A 8D 24 2E 8D 6F 2E E3
 279D:8D 7D 2D 8D DC 2D A2 00 71
 27A5:8E 22 2E 8E 6D 2E 8E 7B 2F
 27AD:2D 8E DA 2D 8E 1A D0 E8 CB
 27B5:8E 19 D0 20 B1 28 20 9B B7
 27BD:2B 20 9F 2B AD 1E D0 AD 95
 27C5:1F D0 A9 01 8D 1A D0 AD 41
 27CD:1E D0 8D B4 2C 4A 8D B3 B5
 27D5:2C 90 2A A2 00 20 E1 2B 3D
 27DD:E0 02 D0 18 EE 22 2E A9 BE
 27E5:0A 8D 27 D0 A9 64 8D 7B 04
 27ED:2D AD 15 D0 29 FB 8D 15 57
 27F5:D0 4C 02 28 E0 03 D0 05 3C
 27FD:78 20 9F 2B 58 4E B3 2C C6
 2805:90 31 A2 01 20 E1 2B E0 0E
 280D:03 D0 18 EE 6D 2E A9 0A 86
 2815:8D 28 D0 A9 64 8D DA 2D 27
 281D:AD 15 D0 29 F7 8D 15 D0 27
 2825:4C 38 28 E0 02 D0 08 78 98
 282D:20 9B 2B 58 4C 38 28 E0 D3
 2835:00 F0 0F A9 7F 8D 00 DC 4D
 283D:AD 01 DC C9 9B D0 88 4C 7B
 2845:8F 28 AD 7B 2D F0 02 A9 AF
 284D:01 AE DA 2D F0 02 09 02 9B
 2855:29 03 F0 DF C9 03 F0 DB 2F

285D:20 CE 2C A2 CE 4A 90 09 EA
 2865:8E F9 3F 8E FD 2F EE 34 0B
 286D:03 4A 90 09 8E F8 3F 8E D9
 2875:FB 2F EE 35 03 AD FB 2F B6
 287D:0D FD 2F D0 F8 A9 32 8D 27
 2885:FA 2F AD FA 2F 10 FB 4C 82
 288D:95 27 78 A2 00 8E 15 D0 E0
 2895:8E 1A D0 8E 04 D4 8E 0B 52
 289D:D4 8E 12 D4 A9 31 A2 EA CD
 28A5:8D 14 03 8E 15 03 A9 81 94
 28AD:8D 0D DC 60 A9 7F 8D 0D 1D
 28B5:DC 8D 0D DD A9 F8 8D 12 B5
 28BD:D0 A9 0C A2 2D 8D 14 03 57
 28C5:8E 15 03 A9 00 8D 20 D0 E4
 28CD:8D 21 D0 A2 07 8E 28 D0 05
 28D5:8E 2A D0 E8 8E 26 D0 E8 38
 28DD:8E 25 D0 A2 02 8E 27 D0 6C
 28E5:8E 29 D0 AD 12 D0 C9 FB 20
 28ED:D0 F9 A9 00 8D 11 D0 AD 5A
 28F5:16 D0 09 10 8D 16 D0 A9 B7
 28FD:FC 8D 18 D0 AD 00 DD 09 72
 2905:03 8D 00 DD A9 0F 8D 15 D3
 290D:D0 8D 1C D0 A2 CC 8E F8 1A
 2915:3F 8E F9 3F E8 8E FA 3F 94
 291D:8E FB 3F A9 28 8D 00 D0 80
 2925:8D 02 D0 A9 80 8D 01 D0 80
 292D:8D 03 D0 A9 02 8D 10 D0 F2
 2935:A9 30 8D 05 D4 8D 0C D4 34
 293D:A9 F0 8D 06 D4 8D 0D D4 7E
 2945:A9 00 8D 01 D4 8D 08 D4 EF
 294D:A9 11 8D 04 D4 8D 0B D4 72
 2955:A9 8F 8D 18 D4 A9 00 A0 81
 295D:3C 85 02 84 03 A9 82 A0 1C
 2965:2B D0 6E 2B A0 8D F3 29 6D
 296D:20 85 2A A9 82 A0 2B 20 1E
 2975:6E 2B 18 69 04 8D F2 29 C8
 297D:A9 87 A0 2B 20 6E 2B 85 E3
 2985:02 0A 0A 65 02 85 02 A9 C6
 298D:00 85 03 06 02 26 03 06 B6
 2995:02 26 03 06 02 26 03 A9 8B
 299D:2E 65 02 85 02 A9 3C 65 8D
 29A5:03 85 03 A9 8C A0 2B 20 33
 29AD:6E 2B 18 65 02 85 02 90 16
 29B5:02 E6 03 A9 82 A0 2B 20 CA
 29BD:6E 2B AA E8 86 04 AE F3 8B
 29C5:29 BD F4 29 85 05 BD F5 FE
 29CD:29 85 06 A6 04 20 50 2A AC
 29D5:AE F3 29 BD FE 29 85 05 2A
 29DD:BD FF 29 85 06 A2 01 20 69
 29E5:50 2A CE F2 29 D0 91 A9 4D
 29ED:1B 8D 11 D0 60 00 00 08 6B
 29F5:2A 08 2A 2C 2A 2C 2A 2C E9
 29FD:2A 26 2A 26 2A 4A 2A 4A AF
 2A05:2A 4A 2A 56 57 57 57 C9
 2A0D:58 5C 5E 5F 5E 5F 5D 5C ED
 2A15:5E 5F 5E 5F 5D 5C 5E 5F AA
 2A1D:5E 5F 5D 5C 5E 5F 5E 5F 76
 2A25:5D 59 5A 5A 5A 5A 5B 3E A0
 2A2D:3F 3F 3F 3F 40 42 3E 3F 93
 2A35:3F 3F 41 42 42 3E 3F 3F E2
 2A3D:41 42 42 42 3E 3F 41 42 E2
 2A45:42 42 42 3E 41 43 44 44 5B
 2A4D:44 44 45 A0 00 B1 05 91 E9
 2A55:02 C8 C4 04 D0 F7 8C 84 B9
 2A5D:2A A0 05 B1 05 AC 84 2A B8
 2A65:91 02 18 A9 28 65 02 85 01
 2A6D:02 A9 00 65 03 85 03 A9 61
 2A75:06 65 05 85 05 A9 00 65 53
 2A7D:06 85 06 CA D0 CD 60 00 22
 2A85:AA BD 20 2B 85 04 BD 21 2E

2A8D:2B 85 05 B1 04 99 00 D8 F3
 2A95:99 00 D9 99 00 DA 99 00 2A
 2A9D:DB C8 D0 F1 C8 B1 04 8D ED
 2AA5:22 D0 C8 B1 04 8D 23 D0 E0
 2AAD:C8 B1 04 8D 1C 2B 18 A9 93
 2AB5:04 65 04 85 04 90 02 E6 8B
 2ABD:05 A0 00 B1 04 8D 1E 2B 95
 2AC5:C8 B1 04 8D 1F 2B 18 A9 C3
 2ACD:02 65 04 85 04 A9 00 A8 C4
 2AD5:65 05 85 05 A0 00 A2 01 6A
 2ADD:B1 04 30 04 AA C8 B1 04 32
 2AE5:29 7F C8 8C 1D 2B A0 00 67
 2AED:91 02 C8 CA D0 FA 18 98 8C
 2AF5:65 02 85 02 90 02 E6 03 AB
 2AFD:AC 1D 2B CC 1F 2B D0 D6 40
 2B05:CE 1E 2B D0 CF 18 98 65 32
 2B0D:04 85 04 A9 00 65 05 85 07
 2B15:05 CE 1C 2B D0 A3 60 00 AD
 2B1D:00 00 00 2A 2B 2A 2B 58 C6
 2B25:2B 58 2B 58 2B 0E 0E 02 C1
 2B2D:08 01 02 C8 C9 0C 03 CA E3
 2B35:CB CC 01 02 CD CE 0B 08 AC
 2B3D:C6 26 00 C7 C7 26 00 C6 9A
 2B45:01 04 C6 26 00 C7 01 02 7B
 2B4D:CF D0 0C 03 D1 D2 D3 01 F3
 2B55:02 DA D5 0E 0E 03 03 01 01
 2B5D:04 BE 26 3F C0 17 04 C2 4B
 2B65:26 00 C1 01 04 C3 26 44 D6
 2B6D:C5 48 98 48 20 BE 0E 68 76
 2B75:A8 68 20 28 BA 20 9B BC 0B
 2B7D:A4 64 A5 65 60 83 20 00 9B
 2B85:00 00 85 10 00 00 00 85 13
 2B8D:28 00 00 00 89 13 80 00 91
 2B95:00 88 2F 00 00 00 A2 00 39
 2B9D:F0 02 A2 02 8E E0 2B A9 59
 2BA5:96 A0 2B 20 6E 2B 18 69 90
 2BAD:35 48 A9 91 A0 2B 20 6E 5F
 2BB5:2B 18 69 1A AE E0 2B 9D 63
 2BRD:04 D0 68 9D 05 D0 98 69 37
 2BC5:00 0A EA E0 02 D0 01 0A 4D
 2BCD:8D E0 2B AD 10 D0 3D DD 7F
 2BD5:2B 00 E0 2B 8D 10 D0 60 82
 2BDD:FB 00 F7 00 A9 00 8D CB 65
 2BE5:2C 8E B5 2C 8A 0A AD AE
 2BED:CB 2C 0A A8 4A CD B5 2C 22
 2BF5:F0 5D AD B4 2C 39 C4 2C 19
 2BFD:F0 55 38 BD 01 D0 F9 01 45
 2C05:D0 B0 04 49 FF 69 01 99 48
 2C0D:BD 2C 38 BD 00 D0 F9 00 69
 2C15:D0 8D CC 2C 00 4D 10 D0 7D
 2C1D:39 C4 2C D0 03 A9 00 2C C0
 2C25:A9 01 8D B6 2C AD 10 D0 B8
 2C2D:3D C4 2C D0 03 A9 00 2C D2
 2C35:A9 01 28 ED B6 2C B0 0F 5D
 2C3D:C9 FE F0 13 18 AD CC 2C C6
 2C45:49 FF 69 01 4C 56 2C C9 5D
 2C4D:01 F0 04 AD CC 2C 2C A9 D6
 2C55:FF 99 BC 2C EE CB 2C AD 1B
 2C5D:CB 2C C9 04 D0 8C A2 03 21
 2C65:8E CB 2C A9 00 D0 B8 2C 2C
 2C6D:CA 10 FA A2 03 A9 00 A0 18
 2C75:07 48 BD B8 2C 8D CC 2C 04
 2C7D:68 2C CC 2C 30 D0 D9 BC 8F
 2C85:2C B0 06 8E CD 2C B9 BC 19
 2C8D:2C 48 98 4A 68 B0 01 CA 98
 2C95:88 10 DE AE CD 2C A9 80 EF
 2C9D:9D B8 2C CE CB 2C D0 CB E1
 2CA5:A2 03 BD B8 2C F0 03 CA 49
 2CAD:10 F8 8E B7 2C 60 00 00 7C
 2CB5:00 00 00 00 00 00 00 0E

PROGRAMS

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2CBD:00 00 00 00 00 00 01 17
2CC5:00 02 00 04 00 08 00 00 FE
2CCD:00 A0 0F 8C 05 D4 8C 0C 99
2CDS:D4 A0 0A 8C 06 D4 8C 0D 74
2CDD:D4 A0 96 8C 0E D4 A0 20 89
2CES:8C 10 D4 A0 03 8C 11 D4 6E
2CED:A0 81 8C 04 D4 8C 0B D4 8C
2CF5:A0 40 8C 12 D4 A0 02 8C 1B
2CFD:FA 2F 78 A0 8D 8C 14 03 82
2D05:A0 2F 8C 15 03 58 60 20 B8
2D0D:20 2D 20 88 2D 20 E7 2D BA
2D15:20 2F 2E 20 7A 2E 20 F8 D8
2D1D:2E 68 A8 68 AA A9 01 8D CF
2D25:19 D0 68 40 AD 15 D0 29 DD
2D2D:04 D0 4A AD 7B 2D F0 05 59
2D35:CE 7B 2D D0 40 AD 7D 2D 69
2D3D:C9 0A D0 0F A9 02 8D 27 A1
2D45:D0 20 9B 2B A9 00 8D 7D 1C
2D4D:2D F0 05 CE 7C 2D D0 25 67
2D55:A9 06 8D 7C 2D AE 7D 2D CB
2D5D:BD 7E 2D 8D 00 D4 E8 BD 97
2D65:7E 2D 8D 01 D4 E8 8E 7D F0
2D6D:2D E0 0A D0 08 AD 15 D0 D6
2D75:09 04 8D 15 D0 60 00 06 66
2D7D:0A 39 35 3E 2A A5 1F 1F FA
2D85:15 00 00 AD 15 D0 29 08 8B
2D8D:D0 4A AD DA 2D F0 05 CE 4C
2D95:DA 2D D0 40 AD 7D 2D C9 4E
2D9D:0A D0 0F A9 07 8D 28 D0 3D
2DA5:20 9F 2B A9 00 8D 7D 2D 56
2DAD:F0 05 CE 7C 2D AE 7D 25 A9 04
2DB5:06 8D 7C 2D AE 7D 2D BD 5C
2DBD:0D 2D 8D 07 D4 E8 BD DD 18
2DC5:2D 8D 08 D4 E8 8E 7D 2D 12
2DCD:E0 0A D0 08 AD 15 D0 09 22
2DD5:08 8D 15 D0 60 00 06 0A 60
2DDD:6B 2F A2 25 31 1C D1 12 10
2DES:00 00 AD 22 2E F0 35 AD 65
2DED:24 2E C9 0A D0 07 A9 00 B5
2DFS:8D 24 2E F0 05 CE 23 2E CC
2DFD:D0 22 A9 06 8D 23 2E AE E2
2E05:24 2E BD 25 2E 8D 00 D4 85
2E0D:E8 BD 25 2E 8D 01 D4 E8 D7
2E15:8E 24 2E E0 0A D0 05 A9 DC
2E1D:00 8D 22 2E 60 00 06 0A 1D
2E25:1F 15 A5 1F 3E 2A 39 35 3F
2E2D:00 00 AD 6D 2E F0 38 AD 69
2E35:6F 2E C9 0A D0 07 A9 00 A4
2E3D:8D 6F 2E F0 05 CE 6E 2E 7F
2E45:D0 25 A9 06 8D 6E 2E AE 1A
2E4D:6F 2E BD 70 2E 8D 07 D4 36
2E55:E8 BD 70 2E 8D 08 D4 E8 A5
2E5D:8E 6F 2E E0 0A D0 08 A9 FD
2E65:00 8D 6D 2E 8D 08 D4 60 4C
2E6D:00 06 0A D1 12 31 1C A2 D9
2E75:25 6B 2F 00 00 AD 1F D0 EA
2E7D:4A 48 90 1A AD F2 2E 8D E7
2E85:00 D0 AD 10 D0 29 FE D0 03
2E8D:F3 2E 8D 10 D0 AD F4 2E 77
2E95:8D 01 D0 4C AF 2E AD 00 69
2E9D:D0 8D F2 2E AD 10 D0 29 7F
2EA5:01 8D F3 2E AD 01 D0 8D E7
2EAD:F4 2E 68 4A 48 90 1A AD 28
2EB5:F5 2E 8D 02 D0 AD 10 D0 98
2EBD:29 FD D0 F6 2E 8D 10 D0 D7
2EC5:AD F7 2E 8D 03 D0 4C E2 6C
2ECD:2E AD 02 D0 8D F5 2E AD 48
2ED5:10 D0 29 02 8D F6 2E AD 06
2EDD:03 D0 8D F7 2E 68 4A 48 11
2EE5:90 03 20 9B 2B 68 4A 90 29

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2EED:03 20 9F 2B 60 28 00 80 9E
2EF5:28 02 80 AD 00 DC 29 0F A6
2EFD:49 0F AA AD 10 D0 29 01 0A
2F05:8D 8C 2F 18 AD 00 D0 7D 41
2F0D:6B 2F 8D 00 D0 AD 8C 2F 24
2F15:7D 76 2F 8D 8C 2F AD 10 1B
2F1D:D0 29 FE 0D 8C 2F 8D 10 2B
2F25:D0 18 AD 01 D0 7D 81 2F 66
2F2D:8D 01 D0 AD 01 DC 29 0F 64
2F35:49 0F AA AD 10 D0 4A 29 AD
2F3D:01 8D 8C 2F 18 AD 02 D0 50
2F45:7D 6B 2F 8D 02 D0 AD 8C 37
2F4D:2F 7D 76 2F 0A 8D 8C 2F 33
2F55:AD 10 D0 29 FD 0D 8C 2F A7
2F5D:8D 10 D0 18 AD 03 D0 7D BA
2F65:81 2F 8D 03 D0 60 00 00 3A
2F6D:00 00 FE FE FE 00 02 02 99
2F75:02 00 00 00 00 FF FF FF D4
2F7D:00 00 00 00 00 FE 02 00 DB
2F85:00 FE 02 00 00 FE 02 00 E3
2F8D:CE FA 2F D0 08 A9 80 8D 7A
2F95:04 D4 8D 0B D4 AD FB 2F 12
2F9D:F0 21 CE FC 2F D0 1C A9 05
2FA5:05 8D FC 2F EE F8 3F AD 04
2FAD:F8 3F C9 D2 D0 0D A9 00 CC
2FB5:8D FB 2F AD 15 D0 29 FE D7
2FBD:8D 15 D0 AD FD 2F F0 21 CC
2FCD:CE FE 2F D0 1C A9 05 8D 5D
2FDD:00 2F EE F9 3F AD F9 3F D8
2FE5:D0 D2 D0 0D A9 00 8D FD 1F
2FED:00 AD 15 D0 29 FD 8D 15 60
2FF5:0F AD 1B D4 8D 01 D4 8D 70
2FFD:08 D4 68 A8 68 AA A9 01 5F
2FFS:8D 19 D0 68 40 00 00 05 09
2FFD:00 05 2C 00 00 00 00 23
3005:00 00 00 00 00 7C 06 7E E1
300D:C6 7E 00 C0 C0 FC C6 C6 CA
3015:C6 FC 00 00 00 7E C0 C0 54
301D:C6 7E 00 06 06 7E C6 C6 5C
3025:C6 7E 00 00 00 7C C6 FE 07
302D:C0 7C 00 0E 18 7E 18 24
3035:18 18 00 00 00 7E C6 C6 F5
303D:7E 06 FC C0 C0 FC C6 C6 58
3045:C6 C6 00 38 00 78 18 18 68
304D:18 7C 00 06 00 06 06 63
3055:06 06 7C C0 C0 CC D8 F8 B9
305D:CC C6 00 78 18 18 18 C6
3065:18 7C 00 00 00 C6 FF FF 0C
306D:DB C3 00 00 00 FC C6 C6 F4
3075:C6 C6 00 00 00 7C C6 C6 31
307D:C6 7C 00 00 00 FC C6 C6 A8
3085:FC C0 C0 00 00 7E C6 C6 FA
308D:7E 06 06 00 00 FC C6 C0 B1
3095:C0 C0 00 00 00 7E C0 7C 7E
309D:06 FC 00 18 18 FE 18 18 C6
30A5:18 0E 00 00 00 C6 C6 C6 05
30AD:C6 7E 00 00 00 C6 C6 C6 80
30BD:7C 38 00 00 00 63 6B 7F 46
30BD:3C 36 00 00 00 C6 6C 38 F6
30C5:6C C6 00 00 00 C6 C6 C6 7D
30CD:7C 38 F0 00 00 FE 0C 38 E4
30D5:06 FE 00 1C 1C 1C 1C 8D
30DD:1C 00 1C 00 00 00 00 CF
30E5:00 00 00 00 00 00 00 46
30ED:00 00 00 00 00 00 00 4E
30F5:00 00 00 00 00 00 00 56
30FD:00 00 00 00 00 00 00 5E
3105:00 00 7C C6 C6 C6 18 71
310D:30 30 1F 06 06 7C C0 C0 3C
3115:7C 06 06 C0 C0 CE DB DB D8

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311D:73 03 03 0C 07 03 7E 30 8C
3125:18 0C F8 3C 66 66 0C 18 76
312D:33 36 FC 60 30 18 0C 06 5C
3135:73 DB 6E 0E 1C 38 00 00 B8
313D:00 00 00 CC 66 66 77 77 9F
3145:66 66 33 18 30 66 66 66 AA
314D:06 7C 00 00 00 FE 06 E6 C0
3155:3E 18 1E 00 FE 18 30 FC 56
315D:06 FC 00 00 3E F0 38 F0 19
3165:3F F3 00 00 00 00 00 64
316D:38 38 70 00 00 00 00 08
3175:38 38 00 00 00 FF FF 02
317D:00 00 00 7C C6 DE F6 C6 0E
3185:C6 7C 00 18 18 78 18 18 D6
318D:18 FF 07 C6 06 1C 70 BA
3195:C0 FE 00 7C C6 06 3C 06 AC
319D:C6 7C 00 0E 1E 36 E6 FF FA
31A5:06 06 00 FE C0 FC 06 88
31AD:C6 7C 00 7C C6 C0 FC C6 54
31B5:C6 7C 00 FE C6 0C 18 18 39
31BD:18 18 00 7C C6 C6 7C C6 0B
31C5:C6 7C 00 7C C6 C6 7E 06 C6
31CD:C6 7C 00 00 00 00 00 00 B2
31D5:00 00 00 00 00 00 00 38
31DD:00 00 00 00 00 00 00 40
31E5:00 00 00 00 00 00 00 48
31ED:00 00 00 00 00 15 15 1A E8
31FD:1A 1B 1B 00 55 55 5A 3A
31FD:AA FF FF 00 00 54 54 A4 54
3205:A4 E4 E4 E4 E4 E4 E4 49
320D:E4 E4 E4 1B 1B 1B 1B 02
3215:1B 1B 1B 1B 1B 1A 1A 15 6D
321D:15 00 00 FF FF AA AA 55 61
3225:55 00 00 E4 E4 A4 A4 54 D9
322D:54 00 00 54 5C 58 78 68 9E
3235:E8 28 28 28 2B 29 2D 25 1D
323D:35 15 D7 00 0A 2A 2B 2D F8
3245:35 15 D5 0D B5 D5 57 5C 25
324D:70 C0 00 5C 7A EA AA 00 B4
3255:00 00 00 00 AA AA AB 0D 1E
325D:00 00 00 0D B5 D5 57 5C A2
3265:00 00 00 5C 7A EA AA 01 65
326D:00 00 00 00 0A A8 A8 68 33
3275:68 28 28 28 28 29 29 2A 02
327D:2A 0A 00 00 00 00 0A A4
3285:AB AD 35 00 00 00 35 D5 12
328D:57 5E 70 00 00 00 70 EA 0F
3295:AA AA 00 00 00 00 0A A4
329D:AB AD 35 00 03 0D 35 D5 76
32A5:57 5E 70 57 54 5C 78 E8 BE
32AD:A8 A0 00 00 00 AA 80 80 BA
32B5:8F 8C 8C 00 00 AA 00 00 41
32BD:FF 00 00 00 00 AA 02 02 D2
32C5:F2 32 32 8C 8C 8F 80 80 63
32CD:AA 00 00 00 00 FF 00 00 87
32D5:AA 00 00 32 32 F2 02 02 16
32DD:AA 00 00 8C 8C 8C 8C 8C 9C
32E5:8C 8C 8C 32 32 32 32 59
32ED:32 32 32 2A A8 83 3F FD B0
32F5:D5 54 42 A8 2A C2 FC 7F 03
32FD:57 15 81 00 00 00 00 83
3305:00 00 00 00 00 00 02 6D
330D:AA 00 0A AA 0A 55 A0 4D
3315:29 55 68 29 7D 68 29 FF E4
331D:68 29 FF 68 29 7D 68 29 C1
3325:55 68 0A 55 A8 0A A0 4A
332D:02 AA 80 00 00 00 00 4F
3335:00 00 00 00 00 00 00 9B
333D:00 00 00 00 00 00 00 A4
3345:00 00 00 00 00 00 00 AB

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334D:00 00 00 00 00 00 00 00 B3
3355:00 00 00 00 28 00 00 AA A7
335D:00 02 96 80 00 AA 00 00 C9
3365:28 00 00 00 00 00 00 00 DF
336D:00 00 00 00 00 00 00 00 D3
3375:00 00 00 00 00 00 00 00 DB
337D:00 00 02 00 00 00 00 00 24
3385:00 00 00 00 00 00 00 02 ED
338D:8A 00 0A AA A0 0A 54 A0 BB
3395:29 55 68 28 7D 60 29 FF 35
339D:68 09 FF 68 29 7C 68 29 36
33A5:55 68 08 55 20 0A AA A0 46
33AD:02 A2 80 00 00 00 00 00 CD
33B5:00 00 00 00 00 00 00 00 1C
33BD:00 00 08 00 00 00 00 00 25
33C5:00 00 00 00 00 00 00 02 2E
33CD:0A 80 0A 8A A0 0A 50 A0 B1
33D5:29 54 68 20 7D 40 08 FF F1
33DD:60 09 FF 68 29 70 68 20 39
33E5:54 68 08 54 20 0A 82 20 25
33ED:02 A2 80 00 00 00 00 00 0E
33F5:00 00 00 00 00 00 00 00 5C
33FD:00 00 00 00 00 00 00 00 65
3405:00 00 00 00 00 00 00 02 6F
340D:0A 00 02 8A A0 08 50 A0 C9
3415:29 54 28 20 70 40 08 3F 0F
341D:60 00 CF 40 29 70 68 20 AF
3425:54 68 08 14 20 00 82 00 1A
342D:02 A0 00 00 00 00 00 00 BE
3435:00 00 00 00 00 00 00 00 9D
343D:00 00 08 00 00 00 00 00 A6
3445:00 00 00 00 00 00 00 02 AF
344D:0A 00 02 88 A0 08 50 80 C9
3455:29 14 28 20 70 40 08 33 26
345D:60 00 CC 00 28 70 68 20 83
3465:44 48 08 14 20 00 82 00 4A
346D:02 20 00 00 00 00 00 00 DE
3475:00 00 00 00 00 00 00 00 DD
347D:00 00 08 00 00 00 00 00 E6

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Jon Piltingsrud lives in New Richland, Minnesota.

MEMORY MONITOR

By Kenneth R. Warrick

Several weeks ago, I was in a room filled with more than 200 people, demonstrating a program that did a lot of string building. After a while, the program came to a screeching halt by the inevitable garbage collection process.

For more than a minute, I had all these people cooling their heels while my trusty 64 did its housekeeping. I thought to myself how helpful it might be to keep a running check on the amount of string storage space still available.

Of course, this number is what we are looking for when we execute the BASIC FRE command. But since FRE performs garbage collection first, it doesn't tell us how much space has been taken up by obsolete string fragments. An onscreen monitor that would keep track of space

available would be just what the doctor ordered!

That's what Memory Monitor for the 64 does. It's a machine language utility that keeps track of the amount of free memory remaining and prints it in the upper left corner of the screen.

Typing It In

Memory is a BASIC loader that creates Memory Monitor when it runs and saves the machine language program to disk with the name Memory Monitor. To help avoid typing errors, enter Memory with The Automatic Proofreader. See "Typing Aids" elsewhere in this section. Be sure to save a copy of the program before you try to run it.

Before I get into the program itself, here's a little of the process that went into its creation.

Sparked by the creative muse, I thumbed through my copy of *Mapping the Commodore 64 and 64C* to find the location of the pointers at the beginning and end of RAM that's available for string storage. The end of the BASIC array storage area (+1) marks the first byte of the string storage area. This address is stored at 49-50 (\$31-\$32). Creating numerical variables takes up memory, moving this number upward and reducing the amount of space left available for strings.

As strings are created, storage begins at 40959 (\$9FFF) and moves downward toward the address found in \$31-\$32. Thus the low end of currently used string space marks the highest address still available for string storage. This address is kept at 51-52 (\$33-\$34). By subtracting, we could find our number.

We don't want our monitor to take up any precious RAM, so we shouldn't write a long BASIC routine to do the job. A machine language routine that's hidden away would be best.

Our routine should run unattended in the background without having to be called repeatedly from our BASIC program. The Kernal has in its bag of tricks a routine which every 1/60 second interrupts whatever BASIC is doing to increment the clock, control flashing of the cursor, update whatever needs to be on the screen, and check the keyboard buffer for any keypresses. By wedging our routine in ahead of all

these housekeeping chores, our task could be taken care of automatically.

Getting back to our little subtraction problem, subtracting the address found at \$31-\$32 from the address found at \$33-\$34 obtains our number in the form of two bytes in the mathematical format of base 256. How do we convert this to decimal format that humans can understand? Programmers familiar with Kernal routines will recall the routine LINPRT found at 48589 (\$BDCD) which is normally used to convert the two-byte BASIC line numbers to decimal and print their ASCII representation to the current output device. That should take care of this project in short order.

Wrong! The interrupt routine has a strict time schedule that will only allow us to wedge in a fairly short routine. Anything longer will crash! That is just what LINPRT is—too long. Back to the drawing board!

By writing an efficient routine that utilizes a large (2048 byte) lookup table, we can meet the time schedule. Those of us who hate mile-long lists of DATA statements will like how short our loader is. Our lookup table is created for us by some fancy mathematics in lines 30-60.

The program searches the first part of our lookup table for the screen POKE codes (which for the digits 0-9 are the same as their ASCII codes) for multiples of 256 (represented by the high byte obtained from our subtraction) in decimal format. The results are parked in a five-byte holding area at \$C800-\$C804.

The second part of the lookup table has the values of 0-256 (represented by the low byte) to be added into our five bytes. Later we correct for any of these sums that exceed 9 and make appropriate carries. Then, poke to the screen, color it white, and exit to the normal interrupt routine.

After reading the code for the working routine from DATA statements and poking it into place, our loader creates the lookup table. It then saves the entire bundle to disk with the filename MEMORY MONITOR by calling the Kernal routine SAVE at 65496.

Once Memory Monitor is on your work disk, you can load it with the ,8,1 extension and run it with SYS 51205.

PROGRAMS

You can also load and run the routine from within a BASIC program with the following line.

10 IF J=0 THEN J=1: LOAD "MEMORY MONITOR",8,1 20 SYS 51205

The manipulation of J prevents endless loop recycling since a LOAD command from program mode automatically executes a GOTO the first program line. While this may be done easily at the beginning of a BASIC program, locating it anywhere else would require a first line of IF J=1 THEN XXX, with XXX the line with the SYS command.

Here's an easier one-liner that may be located anywhere in your program.

10 POKE 780,0: OPEN8,8,8,1,"MEMORY MONITOR": SYS 65493: CLOSE 8: SYS 51205

To turn off Memory Monitor and return to guessing how much memory is left, enter SYS 51326.

MEMORY

```
DM 1 REM COPYRIGHT 1993 - COMP
    UTE PUBLICATIONS INTL LTD
    - ALL RIGHTS RESERVED
HA 5 PRINT"{DOWN}WAIT 60 SECON
    DS...":PRINT"CREATING MEM
    ORY MONITOR"
MC 10 FORI=51205 TO 51338:READ
    A:CK=CK+A:POKEI,A:NEXT
SC 20 IFCK<>16246THENPRINT"ERR
    OR IN DATA STATEMENTS":E
    ND
SX 30 FORN=0TO255:JS=RIGHT$( "0
    0000"+MID$(STR$(256*N),2
    ),5):FORK=1TO5
JB 40 POKE48896+256*K+N,ASC(MI
    D$(JS,K,1)):NEXT
RJ 50 FORN=0TO255:JS=RIGHT$( "0
    00"+MID$(STR$(N),2),3):F
    ORK=1TO3
XK 60 POKE50176+256*K+N,VAL(MI
    D$(JS,K,1)):NEXT:NEXT:OP
    EN8,8,8,"MEMORY MONITOR"
DM 70 POKE250,0:POKE251,192:PO
    KE780,250:POKE781,138:PO
    KE782,200:SYS65496
JK 80 DATA 120,169,18,141,20,3
    ,169,200,141,21,3,88,96,
    56,165,51,229,49,133,251
    ,165
BA 90 DATA 52,229,50,168,185,0
    ,192,141,0,200,185,0,193
    ,141,1,200,185,0,194,141
    ,2
HR 100 DATA 200,185,0,195,141,
    3,200,185,0,196,141,4,2
```

```
00,24,164,251,185,0,197
    ,109,2
QQ 110 DATA 200,141,2,200,185,
    0,198,109,3,200,141,3,2
    00,185,0,199,109,4,200,
    141,4
SF 120 DATA 200,160,5,162,0,13
    4,252,162,0,185,255,199
    ,24,101,252,201,58,144,
    4,24
HG 130 DATA 105,246,232,153,25
    5,3,169,1,153,255,215,1
    36,208,227,76,49,234,12
    0,169
SC 140 DATA 49,141,20,3,169,23
    4,141,21,3,88,96
MC 150 PRINT"[DOWN}ACTIVATE ME
    MORY MONITOR WITH SYS 5
    1205"
```

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CUBIC

By Stephen A. Bakke

Cubic is a logic puzzle for the 64. It resembles a brightly colored cube whose six sides can be twisted to mix up the colors. When the puzzle starts, the colors are mixed randomly. The object of the puzzle is to maneuver the colored pieces so that each side consists of but one of the six colors.

Presenting six sides of a cube on-screen at one time can be a problem. To get around this difficulty, Cubic unfolds the cube and displays the sides next to one another on the screen.

Cubic is written in machine language. To enter it, use MLX, our machine language entry program. See "Typing Aids" elsewhere in this section. When MLX prompts, respond to the following starting and ending addresses.

**Starting address: 0801
Ending address: 0EE8**

Be sure to save a copy of the program before exiting MLX. Although Cubic is written in machine language, it loads and runs like a BASIC program. Operator input is controlled exclusively by a joystick plugged into port 2.

Getting Started

The top screen line is Cubic's status line. It displays the program name, number of turns taken, and the best score achieved. Below it are six squares

that represent the sides of a cube. Each square consists of 16 smaller squares of various colors arranged in four columns by four rows.

To solve the puzzle, swap rows and columns of squares between the sides of the cube until all squares within each of the six sides contain a single color. Columns run up and down and are numbered 1 on the left through 4 on the right. Rows extend left and right and are numbered 1 on the top through 4 on the bottom.

The bottom screen line is used for operator input. Four inputs are required to exchange a row or column between two sides of the cube. Push the joystick left or right to highlight Row for row or Col for column. Press the fire button to enter your selection.

The next entry determines the row or column. Push the joystick left or right to change the row or column number. Press the fire button when the desired number is displayed.

Then select the cube number from which the swap is desired and press the fire button. Next, select the cube number to which the swap is desired and press the fire button again. The swap will occur, the number of turns will be incremented, and the bottom line will clear in preparation for the next move.

The puzzle is solved when each cube contains only squares of the same color. The screen will remain unchanged while the border cycles through various colors until you press the fire button. After you press the button, the best score will be set, the number of turns will be reset, and the six sides will be scrambled in preparation for another game.

CUBIC

```
0801:0B 08 0A 00 9E 32 30 36 2E
0809:31 00 00 00 A9 80 8D 91 AD
0811:02 A9 15 8D 18 D0 20 4C 98
0819:08 20 30 09 20 E8 0A 20 A4
0821:80 0D 20 07 0A 20 F4 0D F0
0829:20 1A 0B A9 00 8D D1 0E B3
0831:8D D2 0E 20 D9 0D 20 73 37
0839:0A EE D6 0E 20 6F 0D 4C EA
0841:FB 0C A0 00 C8 D0 FD CA B6
0849:D0 F8 60 A2 00 8E 20 D0 81
0851:8E 21 D0 20 44 E5 A2 00 0C
0859:A0 05 18 20 F0 FF A9 5F 3A
0861:A0 0E 20 1E AB A2 18 A0 E3
0869:05 18 20 F0 FF A9 80 A0 5D
0871:0E 20 1E AB A9 3A A0 00 86
```



```

0879:A2 04 86 F8 A2 15 86 F7 AA
0881:91 F7 A2 1F 86 F7 91 F7 CD
0889:A2 07 86 F8 A2 C8 86 F7 4A
0891:91 F7 A2 CC 86 F7 91 F7 B8
0899:A2 D4 86 F7 91 F7 A2 DD 10
08A1:86 F7 91 F7 A9 0C 8D 86 C3
08A9:02 A9 30 8D CA 0E A9 00 E5
08B1:48 AA BC D8 0E BD DE 0E E8
08B9:EE CA 0E AA 18 20 F0 FF 83
08C1:A9 CA A0 0E 20 1E AB 68 87
08C9:AA E8 8A C9 06 D0 E1 A9 38
08D1:00 48 AA BD 43 0E 8D C9 5C
08D9:0E BD 3D 0E 8D C8 0E 20 B4
08E1:EC 08 68 AA E8 8A C9 06 2D
08E9:D0 E7 60 A9 00 48 AC C9 47
08F1:0E AE C8 0E 18 20 F0 FF D1
08F9:A9 49 A0 0E 20 1E AB AC A3
0901:C9 0E EE C8 0E AE C8 0E B0
0909:18 20 F0 FF A9 54 A0 0E 3B
0911:20 1E AB EE C8 0E 68 AA 19
0919:E8 8A C9 04 D0 CF 60 18 5A
0921:AD CC 0E 0A 6D CC 0E 69 C3
0929:0E 29 0F 8D D3 0E 60 A9 88
0931:00 8D CC 0E 48 AA BD B8 42
0939:0E 8D CD 0E BD BE 0E 8D E2
0941:CE 0E 20 20 09 EE CC 0E EF
0949:20 67 09 20 7D 09 20 67 20
0951:09 20 7D 09 20 67 09 20 0F
0959:7D 09 20 67 09 60 AA E8 0F
0961:8A C9 06 D0 CF 60 A9 00 4C
0969:48 8D D1 0E 20 8F 09 20 8F
0971:A6 09 68 A8 C8 C8 98 C9 15
0979:08 D0 ED 60 18 AD CD 0E A8
0981:69 50 8D CD 0E AD CE 0E BD
0989:69 00 8D CE 0E 60 18 AD BE
0991:CD 0E 60 D1 0E 85 F7 85 D4
0999:F9 AD CE 0E 69 00 85 F8 1E
09A1:69 AC 85 FA 60 A2 00 18 99
09A9:BD C4 0E 65 F7 85 F7 85 2F
09B1:F9 A5 F8 69 00 85 F8 69 51
09B9:AC 85 FA AD D3 0E A0 00 D5
09C1:91 F7 91 F9 E8 E0 04 D0 10
09C9:DE 60 A2 00 18 BD C4 0E 07
09D1:65 FB 85 FB 85 FD A5 FC 72
09D9:69 00 85 FC 69 AC 85 FE 29
09E1:AD D3 0E A0 00 91 FB 91 5B
09E9:FD E8 E0 04 D0 DE 60 18 6C
09F1:AD CF 0E 6D D1 0E 85 FB 35
09F9:85 FD AD D0 0E 69 00 85 AC
0A01:FC 69 AC 85 FE 60 A9 00 A8
0A09:48 A9 00 8D D2 0E 8D D1 40
0A11:0E 20 24 0A 20 73 0A 68 A4
0A19:AA E8 8A C9 FF D0 E9 60 22
0A21:CA CA 60 AD 1B D4 29 07 B9
0A29:20 56 0A AD 1B D4 29 07 84
0A31:AA 18 E0 05 30 03 20 21 FB
0A39:0A 8A 8D D4 0E AD 1B D4 26
0A41:29 07 AA 18 E0 05 30 03 01
0A49:20 21 0A 8A CD D4 0E F0 6E
0A51:EC 8D D5 0E 60 18 6A 8D A0
0A59:CA 0E 90 0B A9 02 8D C9 53
0A61:0E A9 50 8D C8 0E 60 A9 B2
0A69:50 8D C9 0E A9 02 8D C8 5C
0A71:0E 60 AE D4 0E BD B8 0E AE
0A79:8D CD 0E BD BE 0E 8D CE 7D
0A81:0E AE D5 0E BD B8 0E 8D 5E
0A89:CF 0E BD BE 0E 8D D0 0E 03
0A91:20 01 0B 20 C3 0A A9 00 F2
0A99:A8 48 20 8F 09 20 F0 09 C4
0AA1:B1 F7 8D CC 0E B1 FB 8D C7
0AA9:D3 0E 20 A6 09 AD CC 0E 40
0AB1:8D D3 0E 20 CB 09 20 F6 FE
0AB9:0A 68 AA E8 8A E0 04 D0 81
0AC1:D8 60 18 AD CD 0E 6D D2 8C
0AC9:0E 8D CD 0E AD CE 0E 69 11
0AD1:00 8D CE 0E 18 AD CF 0E 29
0AD9:6D D2 0E 8D CF 0E AD D0 D6
0AE1:0E 69 00 8D D0 0E 60 A9 59
0AE9:65 8D 0E D4 8D 0F D4 A9 1F
0AF1:11 8D 12 D4 60 18 AD D1 12
0AF9:0E 6D C9 0E 8D D1 0E 60 BA
0B01:AD CA 0E F0 13 48 18 AD 09
0B09:D2 0E 6D C8 0E 8D D2 0E A0
0B11:68 AA CA 8A E0 00 D0 ED 9E
0B19:60 20 E5 0C 20 79 0C 20 04
0B21:CA 0C AD 00 DC 29 0F C9 C8
0B29:07 F0 16 C9 0B F0 EA AD FD
0B31:00 DC 29 10 D0 EC 20 FA 1A
0B39:0D A2 FF 20 43 08 4C 4E A1
0B41:0B 20 F0 0C 20 AF 0C 20 BB
0B49:94 0C 4C 23 0B A9 CD 85 88
0B51:F7 A9 07 85 F8 A9 01 8D 05
0B59:CA 0E 09 30 91 F7 AD 00 44
0B61:DC 29 0F C9 07 F0 19 C9 A6
0B69:0B F0 30 AD 00 DC 29 10 F7
0B71:D0 EC CE CA 0E 20 FA 0D A5
0B79:A2 FF 20 43 08 4C B5 0B 01
0B81:EE CA 0E AD CA 0E C9 05 85
0B89:D0 02 A9 01 8D CA 0E 09 8A
0B91:30 91 F7 A2 4B 20 43 08 B6
0B99:4C 5F 0B CE CA 0E AD CA B0
0BA1:0E D0 02 A9 04 8D CA 0E C7
0BA9:09 30 91 F7 A2 4B 20 43 C7
0BB1:08 4C 5F 0B A9 D5 85 F7 23
0BB9:A9 01 8D D4 0E 09 30 91 6A
0BC1:F7 AD 00 DC 29 0F C9 07 2D
0BC9:F0 19 C9 0B F0 30 AD 00 2C
0BD1:DC 29 10 D0 EC CE D4 0E 0A
0BD9:20 FA D0 A2 FF 20 43 08 99
0BE1:4C 18 0C EE D4 0E AD D4 A3
0BE9:0E C9 07 D0 02 A9 01 8D AD
0BF1:D4 0E 09 30 91 F7 A2 7F 4B
0BF9:20 43 08 4C C2 0B CE D4 6B
0C01:0E AD D4 0E D0 02 A9 06 EE
0C09:8D D4 0E 09 30 91 F7 A2 C9
0C11:7F 20 43 08 4C C2 0B A9 07
0C19:DE 85 F7 A9 01 8D D5 0E 93
0C21:09 30 91 F7 AD 00 DC 29 CB
0C29:0F C9 07 F0 17 C9 0B F0 12
0C31:2E AD 00 DC 29 10 D0 EC B1
0C39:CE D5 0E 20 FA 0D A2 FF 43
0C41:20 43 08 60 EE D5 0E AD D9
0C49:D5 0E C9 07 D0 02 A9 01 5C
0C51:8D D5 0E 09 30 91 F7 A2 52
0C59:4B 20 43 08 4C 25 0C CE E5
0C61:D5 0E AD D5 0E D0 02 A9 5C
0C69:06 8D D5 0E 09 30 91 F7 A7
0C71:A2 4B 20 43 08 4C 25 0C AD
0C79:A9 C5 85 F7 A9 07 85 F8 75
0C81:A9 00 8A A8 B1 F7 09 80 2E
0C89:91 F7 E6 F7 A6 F7 E0 C9 65
0C91:D0 F2 60 A9 C5 85 F7 A9 53
0C99:07 85 F8 A9 00 8A A8 B1 F9
0CA1:F7 29 7F 91 F7 E6 F7 A6 FA
0CA9:F7 E0 C9 D0 F2 60 A9 C9 72
0CB1:85 F7 A9 07 85 F8 A9 00 93
0CB9:A8 AA B1 F7 09 80 91 F7 EB
0CC1:E6 F7 A6 F7 E0 CD D0 F2 72
0CC9:60 A9 C9 85 F7 A9 07 85 08
0CD1:F8 A9 00 A8 AA B1 F7 29 90
0CD9:7F 91 F7 E6 F7 A6 F7 E0 AE
0CE1:CD D0 F2 60 A9 02 8D C9 B3
0CE9:0E A9 50 8D C8 0E 60 A9 3F
0CF1:50 8D C9 0E A9 02 8D C8 E8
0CF9:0E 60 A9 00 48 AA BD B8 87
0D01:0E 8D CD 0E BD BE 0E 8D B2
0D09:CE 0E A9 00 8D C8 0E 20 0F
0D11:33 0D EE C8 0E 20 7D 09 67
0D19:20 33 0D 20 7D 09 20 33 37
0D21:0D 20 7D 09 20 33 0D 68 5A
0D29:AA E8 8A C9 06 D0 CD 4C 1C
0D31:9E 0D A9 00 48 8D D1 0E 3D
0D39:20 8F 09 20 49 0D 68 AA 64
0D41:E8 E8 8A C9 08 D0 ED 60 B7
0D49:A0 00 AE D1 0E F0 08 B1 9C
0D51:F7 CD D3 0E D0 F0 AE 68
0D59:C8 0E F0 03 4C 50 0D B1 19
0D61:F7 8D D3 0E 60 68 68 68 14
0D69:68 68 68 4C 29 08 A2 00 52
0D71:A0 16 18 20 F0 FF AE D6 22
0D79:0E A9 00 20 CD BD 60 A2 CF
0D81:00 A0 20 18 20 F0 FF AE BC
0D89:D7 0E A9 00 20 CD BD 60 5C
0D91:18 AD D6 0E CD D7 0E B0 79
0D99:03 8D D7 0E 60 20 91 0D 28
0DA1:A9 00 8D D6 0E A2 18 A0 7B
0DA9:05 18 20 F0 FF A9 9C A0 DF
0DB1:0E 20 1E AB A0 00 C8 C0 B0
0DB9:10 D0 02 A0 01 8C 20 D0 A5
0DC1:98 48 A2 FF 20 43 08 68 15
0DC9:A8 AD 00 DC 29 10 D0 E6 83
0DD1:A0 00 8C 20 D0 4C 17 08 BD
0DD9:A9 20 A0 00 A2 CD 86 F7 36
0DE1:A2 07 86 F8 91 F7 A2 D5 F6
0DE9:86 F7 91 F7 A2 DE 86 F7 8C
0DF1:91 F7 60 A9 0C 8D 18 D4 15
0DF9:60 A9 10 8D 05 D4 A9 30 D8
0E01:8D 06 D4 A9 0A A2 00 18 8D
0E09:69 05 E8 E0 0A D0 F8 8D 59
0E11:01 D4 A9 25 8D 00 D4 A9 2A
0E19:21 8D 04 D4 A2 14 20 43 DF
0E21:08 A9 00 8D 04 D4 8D 05 18
0E29:D4 8D 06 D4 8D 00 D4 8D C4
0E31:01 D4 8D 17 D4 8D 16 D4 04
0E39:8D 15 D4 60 04 04 04 0E 48
0E41:0E 0E 05 10 1B 05 10 1B B1
0E49:12 CF D0 CF D0 CF D0 CF B0
0E51:D0 92 00 12 CC BA CC BA 41
0E59:CC BA CC BA 92 00 1E 43 E3
0E61:55 42 49 43 9F 20 20 20 F3
0E69:20 20 20 54 55 52 4E 53 CA
0E71:20 20 20 20 20 20 42 45 F6
0E79:53 54 20 20 20 20 00 52 2E
0E81:4F 57 20 43 4F 4C 20 20 5F
0E89:20 20 46 52 4F 4D 20 20 BB
0E91:20 20 20 20 20 54 4F 20 DC
0E99:20 20 00 50 52 45 53 53 74
0EA1:20 46 49 52 45 20 54 4F 50
0EA9:20 50 4C 41 59 20 41 47 9C
0EB1:41 49 4E 2E 2E 00 A5 3D
0EB9:B0 BB 35 40 4B 2C 2C 2C 57
0EC1:2E 2E 2E 00 01 27 01 02 EE
0EC9:50 00 00 06 3B 2F 00 00 05
0ED1:00 00 0D 00 00 00 DE 09 56
0ED9:14 1F 09 14 1F 03 03 03 38
0EE1:0D 0D 00 00 00 00 00 69

```

Steven Bakke writes puzzling programs in Aurora, Colorado. □

AUTOMATIC PROOFREADER

The Automatic Proofreader helps you type in program listings for the 128 and 64 and prevents nearly every kind of typing mistake.

Type in Proofreader exactly as listed. Because the program can't check itself, be sure to enter each line carefully to avoid typographical errors or other mistakes. Don't omit any lines, even if they contain unusual commands. After you've finished, save a copy of the program before running it.

Next, type *RUN* and press Return. After the program displays the message *Proofreader Active*, you're ready to type in a BASIC program.

Every time you finish typing a line and press Return, Proofreader displays a two-letter checksum in the upper left corner of the screen. Compare this result with the two-letter checksum printed to the left of the line in the program listing. If the letters match, the line probably was typed correctly. If not, check for your mistake and correct the line. Also, be sure not to skip any lines.

Proofreader ignores spaces not enclosed in quotation marks, so you can omit or add spaces between keywords and still see a matching checksum. Spaces inside quotes are almost always significant, so the program pays attention to them.

Proofreader does not accept keyword abbreviations (for example, ? instead of PRINT). If you use abbreviations, you can still check the line by listing it, moving the cursor back to the line, and pressing Return.

If you're using Proofreader on the 128, do not perform any GRAPHIC commands while Proofreader is active. When you perform a command like GRAPHIC 1, the computer moves everything at the start of BASIC program space—including the Proofreader—to another memory area, causing Proofreader to crash. The same thing happens if you run any program with a GRAPHIC command while Proofreader is in memory.

Though Proofreader doesn't interfere with other BASIC operations, it's a good idea to disable it before running another program. To disable it, turn the computer off and then on. A gentler method is to SYS to the computer's built-in reset routine (65341 for the 128, 64738 for the 64).

AUTOMATIC PROOFREADER

```
0 CLR
10 VE=PEEK(772)+256*PEEK(773):
   LO=43:HI=44:PRINT "{CLR}
   {WHT}AUTOMATIC PROOFREADER
   {SPACE}FOR ";
20 IF VE=42364 THEN PRINT "64"
30 IF VE=17165 THEN LO=45:HI=4
   6:WAIT CLR:PRINT "128"
40 SA=(PEEK(LO)+256*PEEK(HI))+
   6:FOR J=SA TO SA+166:READ B
   :POKE J,B:CH=CH+B:NEXT
50 IF CH<>20570 THEN PRINT "*E
   RROR* CHECK TYPING IN DATA
   {SPACE}STATEMENTS":END
60 FOR J=1 TO 5:READ RF,LF,HF:
   RS=SA+RF:HB=INT(RS/256):LB=
   RS-(256*HB)
70 CH=CH+RF+LF+HF:POKE SA+LF,L
   B:POKE SA+HF,HB:NEXT
80 IF CH<>22054 THEN PRINT "*E
   RROR* RELOAD PROGRAM AND CH
   CK FINAL LINE":END
90 IF VE=17165 THEN POKE SA+14
   ,22:POKE SA+18,23:POKE SA+29
   ,224:POKE SA+139,224
100 POKE SA+149,PEEK(772):POKE
   SA+150,PEEK(773):PRINT "
   {CLR}PROOFREADER ACTIVE"
110 SYS SA:POKE HI,PEEK(HI)+1:
   POKE (PEEK(LO)+256*PEEK(HI
   ))-1,0:NEW
120 DATA120,169,73,141,4,3,169
   ,3,141,5,3,88,96,165,20,13
   3,167
130 DATA165,21,133,168,169,0,1
   41,0,255,162,31,181,199,15
   7,227
140 DATA3,202,16,248,169,19,32
   ,210,255,169,18,32,210,255
   ,160
150 DATA0,132,180,132,176,136,
   230,180,200,185,0,2,240,46
   ,201
160 DATA34,208,8,72,165,176,73
   ,255,133,176,104,72,201,32
   ,208
170 DATA7,165,176,208,3,104,20
   8,226,104,166,180,24,165,1
   67
180 DATA121,0,2,133,167,165,16
   8,105,0,133,168,202,208,23
   9,240
190 DATA202,165,167,69,168,72,
   41,15,168,185,211,3,32,210
   ,255
200 DATA104,74,74,74,74,168,18
   5,211,3,32,210,255,162,31,
   189
210 DATA227,3,149,199,202,16,2
   48,169,146,32,210,255,76,8
   6,137
220 DATA65,66,67,68,69,70,71,7
   2,74,75,77,80,81,82,83,88
230 DATA 13,2,7,167,31,32,151,
   116,117,151,128,129,167,13
   6,137
```

ONLY ON DISK

In addition to the type-in programs found in each issue of the magazine, Gazette Disk offers bonus programs. This month we present three spreadsheet templates that are ready to load into SpeedCalc or GemCalc.

Bond Fund

By E.A. Ramirez
Guaynabo, PR

There are several ways to determine capital gains and losses for bond mutual funds, but the most advantageous to the taxpayer is by calculating the cumulative price per share before each transaction. This template does that. Its printout is suitable for submission to the IRS as an addendum to tax forms.

Mortgage Analyzer Decision Maker

By Dave Pankhurst
Montreal, PQ
Canada

With Mortgage Analyzer, you can see any year in the payback of a mortgage, check the balance owed, principal and interest paid, total mortgage cost, monthly payments, and more.

Having trouble making decisions? With Decision Maker, your 64 can help. List up to seven choices and the advantages of each one. Assign each advantage a numerical rating, and the computer will do the rest.

Don't forget that Gazette Disk now contains public domain programs and shareware. For a complete rundown of the PD programs on this month's disk, see "PD Picks."

You can have these programs and all of the type-in programs found in this issue—ready to load and run—by ordering the August Gazette Disk. The price is \$9.95 plus \$2.00 shipping and handling. Send your order to Gazette Disk, COMPUTE Publications, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. You can order by credit card by calling (919) 275-9809, extension 283.